Diadromous fish monitoring programs in the Miramichi River system in 2011

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

With the help from many partners, the Science Branch of the Department of Fisheries and Oceans' Gulf Region, conducts multiple diadromous fish monitoring programs within the Miramichi watershed each year. The role of the monitoring programs is to collect biological information on a variety of species, and in many cases, serve as a platform to evaluate the size of populations. This report characterizes the 2011 monitoring programs in the Miramichi watershed, summarizes the data collected from each of them, and in some cases, provides basic analyses and trends. Specifically we report on the following programs for 2011: the Atlantic salmon smolt program, the index trapnet program, the Atlantic salmon mark and recapture experiment, the New Brunswick Department of Natural Resources headwater protection barrier program, the electrofishing surveys of the Miramichi watershed, the freshwater temperature monitoring program, and the commercial gaspereau fishery sampling program. Information on the biological characteristics of many species and different life stages is reported for 2011.

RÉSUMÉ

Chaque année, avec l'aide de nombreux partenaires, la Direction des sciences du ministère des Pêches et des Océans de la région du Golfe mène plusieurs programmes de surveillance des poissons migrateurs dans le bassin de la Miramichi. Le rôle des programmes de surveillance consiste à recueillir des informations biologiques sur une variété d'espèces, et dans bien des cas, est utilisé comme plate-forme pour évaluer l'abondance des populations. Ce rapport caractérise les programmes de surveillance pour l'année 2011 dans le bassin de la Miramichi, résume les données recueillies pour chacun d'eux, et dans certains cas fournit des analyses et des tendances de base. Plus précisément, nous rapportons sur les programmes suivants pour 2011 : le programme du saumoneau du saumon de l'Atlantique, le programme de l'indice du filet-trappe, l'étude de marquage et recapture du saumon de l'Atlantique, le programme du Département des Ressources Naturelles du Nouveau-Brunswick sur la protection des eaux d'amont à l'aide d'une barrière, les relevés avec la pêche électrique du bassin de la Miramichi , le programme de surveillance de la température de l'eau, et le programme d'échantillonnage de la pêche commerciale du gaspareau. L'information sur les caractéristiques biologiques de nombreuses espèces et les différents cycles de vie sont présentés pour 2011.

INTRODUCTION

The Miramichi River in northern New Brunswick is home to 47 species of fish (Hanson and Courtenay, 1995), of which 11 are diadromous (Chaput 1995). Many of these species have significant cultural value to aboriginal peoples and many are exploited commercially and recreationally. For example, the Atlantic salmon run to the Miramichi River is the largest in North America and is exploited for food, social and ceremonial purposes by First Nations and for recreation by anglers. The commercial fisheries for gaspereau (collectively Alewife and Blueback herring), American eel, and Rainbow smelt in the Miramichi system are the largest of their kind in DFO's Gulf Region. The upper Northwest Miramichi estuary remains the only confirmed spawning location for striped bass in the southern Gulf of St. Lawrence (Douglas and Chaput 2011).

The cultural, economic, and ecologic importance of diadromous fish and fisheries in the Miramichi River require resource management based on sound scientific advice. The main objective of the various monitoring programs in the Miramichi system is to collect scientific information on the stocks so informed management decisions can be made. While many Miramichi programs have a long history (index trapnets since 1954, and electrofishing surveys since 1970), others are relatively new. In both cases however, monitoring programs are continually adapting to new situations and new opportunities to improve the understanding of the species which should ultimately improve the management of the resources.

The objective of this report is to characterize the 2011 diadromous fish monitoring programs in the Miramichi watershed, to summarize the collected data, and in some cases, provide basic analysis. This report is intended to document specific program details, highlight and acknowledge the contributions of partners, and serve as a quick reference to field operations in the Miramichi watershed in 2011.

ATLANTIC SALMON SMOLT PROGRAM

The earliest efforts to monitor emigrating Atlantic salmon smolts from the Miramichi watershed were in 1950 when a counting fence located at Curventon on the Northwest Miramichi River was operated by the Fisheries Research Board of Canada (now DFO) (Henderson 1965; Schofield 1968). The operation of that fence ended in 1973 and along with it, so did the sampling program for salmon smolts. Smolt work has recently been re-initiated on the Northwest Miramichi River with the installation of two trapnets in the estuary; one at Cassilis (1998-2006 and 2011), the other at Hackett's Beach (1999-2000), and rotary screw traps (RSTs and often referred to as smolt wheels) at various locations on the Little Southwest Miramichi River (one near the mouth of Catamaran brook between 1999 and 2008, one at Sillikers in 2005 and 2006, and one at the Oxbow between 2007 and 2011) (Chaput et al. 2002). These monitoring programs have all had the same objective of quantifying smolt production which was accomplished for the Northwest Miramichi system between 1999 and 2006 and for the Little Southwest Miramichi River alone between 2005 and 2011. This work was a collaborative effort between the Northumberland Salmon Protection Association (NSPA), the University of New Brunswick, and the DFO.

Similar efforts to determine smolt production on the Southwest Miramichi River began in 2001, a collaborative effort by the Miramichi Salmon Association (MSA),

Bowater/International Paper Inc., and the DFO. The smolt monitoring program on the Southwest branch began in 2001 with the installation of a trapnet in the estuary at Millerton and one smolt wheel in each of the Cains and Dungarvon rivers and Rocky Brook. This program lasted for a decade (2001-2010) and produced estimates of smolt abundance in each year except 2005 (MSA unpublished data). International Paper Inc. continued to operate a smolt wheel in Rocky Brook in 2011 but the data are not presented here.

The inability for salmon to meet their conservation objectives on the Northwest Miramichi River since 2001, and the lowest estimates of conservation attainment around 30% in 2008 and 2009, prompted the MSA to redirect their smolt work from the Southwest Miramichi River to the Northwest Miramichi River in 2011. The MSA operated two smolt wheels in the Northwest Miramichi system, as well as, DFO's regular index trapnet in the estuary at Cassilis during the 2011 smolt run. Similar to previous years, the NSPA operated a smolt wheel in the Little Southwest Miramichi River at the Oxbow site.

METHODS

Rotary screw traps (RSTs)

Three RSTs were installed in the Northwest Miramichi watershed on May 3, 2011; one on the main stem of the Northwest Miramichi River at Trout Brook, one on the Big Sevogle River near its mouth, and one on the Little Southwest Miramichi River at the Oxbow site (Table 1, Fig. 1). The RST's at all the locations were 1.83 m in diameter and were fished at least once a day, usually in the morning. All captured fish were identified to species and counted individually except on rare occasions when estimates of rainbow smelt and common shiners were required due to their large abundances. Complete counts of salmon smolts were always possible at each of the smolt wheels.

A maximum of 25 smolts were measured daily for fork length (nearest 1 mm) from each of the wheels, and from these, every fifth smolt was scale sampled for later age determination. Any smolt mortalities were retained, frozen, and later thawed at the lab for detailed biological sampling which included measurements of fork length (nearest 1 mm) and whole weight (nearest 0.1 g), dissection to determine sex, and removal of scales for later aging.

The majority of smolts captured by the RSTs were tagged with individually numbered, clear, polyethylene streamer tags which measured 50 mm in length (with a 10 mm notch in the middle) and 2.5 mm in width. Tagged smolts were immediately transported back upriver (5.3 kms on the Little Southwest Miramichi, 5.0 kms on the Northwest Miramichi, and 2.5 kms on the Big Sevogle) and released for potential recapture at the same RST (or trapnet in the estuary at Cassilis; see below). Tagging mortality was not a concern because of the short distance between the tagging and release sites and the short duration between the time of tagging and subsequent recapture (usually 24 hours). The assumption that both tagged and untagged smolts would be captured in the same proportion throughout the run was made. Similar to the methods used to estimate smolt abundance in the Northwest Miramichi River previously (Chaput et al. 2002) and in the Southwest Miramichi River (MSA unpublished data), the Petersen method within a Bayesian framework (Gazey and Staley 1986) was used to derive individual estimates of smolt production from each of the three major Northwest Miramichi tributaries.

Cassilis smolt trapnet

In 2011, the DFO's index trapnet in the Northwest Miramichi estuary at Cassilis was constructed in its regular location, approximately 5 kms below the confluence of the Little Southwest and the Northwest Miramichi rivers (Fig. 1). The trapnet is locally known as a "T" trap design with a leader extending perpendicular from shore (approx. 33.5 m) and ending at the trap (rectangular box measuring 18.3 m long, 3.7 m wide, and 4.6 m deep) near the channel of the river. The leader and trap is hung from a framework of wooden brail which is nailed together and supported by wooden pickets which have been driven about 1 m into the bottom of the river with a pile driver. For the purpose of catching smolts, the trap was constructed with knotless webbing that had a stretched mesh size of 19 mm. The leader's stretched mesh size was 125 mm and was configured to catch only downstream migrating fish (i.e. the door of the trap was on the upstream side of the leader). The construction of the Cassilis trapnet began on May 12 and the net was first set and checked on May 17, and May 18, respectively. The trapnet was fished daily without interruption until June 10 when the smolt run had finished.

All fish captured at the Cassilis trapnet were identified to species and counted. On five occasions the abundance of rainbow smelts was estimated due to their large quantity and time constraints. All Atlantic salmon smolts were inspected to determine their origin; a hatchery origin fish was identified as having a missing adipose fin which was clipped at the time of stocking. Smolts were also examined for the presence of a streamer tag that would have been previously applied at the three RST's located up-river. A daily sub sample of up to 100 smolts was measured for fork length (nearest 1 mm), and from which every fifth smolt, up to a maximum of 20, was retained and frozen for detailed sampling at the lab.

To account for the potential mortality and/or tag loss during the smolts' descent from the tributaries to the estuary, the number of tagged fish available to be recaptured at the Cassilis trapnet was reduced by 10%. We assumed that the trapnet would capture both tagged and untagged smolts in the same proportion throughout the run. Recaptured smolts from the trapnet were pooled to estimate the total smolt production for the Northwest Miramichi River. The mark recapture data was treated similar to what was described above and previously (Gazey and Staley 1986; Chaput et al. 2002).

RESULTS

Little Southwest Miramichi River RST at Oxbow

The RST on the Little Southwest Miramichi River operated between May 3 and June 5, 2011 (Table 1). There were two occasions during the study when the wheel needed to be lifted due to high discharge (between 8 am on May 5 to 8 am on May 9) or the crew's inability to process the large volumes of rainbow smelt rapidly enough to avoid significant crowding and mortality (May 20 from 8:30 am until 10 pm). The large catches of smelt required that the RST be checked twice daily between May 14 and May 22 to avoid filling of the live well and the likely mortality of fish.

Ten species of fish representing seven different families were captured at the RST on the Little Southwest Miramichi River in 2011. Captures of all fish totaled 94,129 of which 97% were rainbow smelt (Table 2). The second most abundant catch was Atlantic salmon smolts which totaled 1,928 fish. The total catch of smolts in 2011 was about 16% below the average catch of smolts between 2007 and 2010 for this RST at this location.

Atlantic salmon smolts were captured every day that the RST was in operation with the peak catch (n = 285) on May 26, 2011; the latest date for the peak catch since this RST began operating at this location. Smolt catches increased on May 21 and coincided with an increasing trend in water temperatures above 10°C (Fig. 2).

The majority (55%) of smolts captured in the Little Southwest Miramichi River smolt wheel were marked with streamer tags bearing the individual numbers between the series B36,501 to B36,988 and B57,001 to B57,597. Of the 1,036 smolts tagged, transported upstream, and released to the river, 29 were recaptured (Table 3). This equated to a recapture rate or catch efficiency of 2.8% for this wheel in 2011. The abundance of smolts emigrating from the Little Southwest Miramichi in 2011 was estimated to be 67,900, with lower and upper confidence intervals of 49,900 and 104,500, respectively (Table 4). This estimate equates to approximately 0.9 (0.6-1.3) smolts per 100 m^2 of fluvial habitat in the Little Southwest Miramichi River. The abundance of smolts estimated in 2011 should be considered an underestimate as the wheel was raised for a few days when smolts were emigrating.

More than half (55%) of recaptured smolts had been tagged and released the previous day. Thirty-one percent of smolts were recaptured after two days of being released and the maximum amount of time between the release and recapture date was five days (1 smolt) (Table 5).

Smolt lengths have been relatively constant over the 12 years of sampling in the Little Southwest Miramichi River. The mean fork length of 13.2 cm in 2011 is similar to previous years and the size range of 90% of the smolts has consistently been between 11.0 and 15.0 cm (Fig. 3). There were about equal numbers of female and male wild smolts from the Little Southwest Miramichi River in 2011 and the run was comprised of 40% and 59% of two and three year old smolts respectively. Similar to previous years, four year old smolts comprised less than 1% of the run. No smolts of hatchery origin were intercepted in the Oxbow RST in 2011 (Table 6). Average whole weight after thawing was 21.9 g (range 9.8 – 35.9 g). The power function Weight = 7×10^{-5} * length $^{2.616}$ provided a reasonable fit ($r^2 = 0.82$) to the thawed length and weight data collected from smolts that died in the Oxbow RST in 2011 (Fig. 4).

Northwest Miramichi River RST at Trout Brook

The Northwest Miramichi RST began operation on May 2 but was raised for four days between May 4 and May 7 due to a high water event. The RST was reset on May 8 and operated daily until June 4, 2011 (Table 1).

Ten species of fish representing seven different families were captured at the RST on the Northwest Miramichi River in 2011 (Table 7). Captures of all fish totaled 2,180 of which 55% were salmon smolts and 27% were salmon parr. Sea lamprey ammocoetes comprised the next largest catch (n=154).

Atlantic salmon smolts were captured daily until June 1, 2011 but catches were variable throughout the run and ranged from a low of eight on May 17 to 307 on May 22, 2011. It does not appear that many smolts emigrated prior to water temperatures achieving a daily mean of 7°C on May 9 (Fig. 2).

The majority (91%) of smolts captured in the Northwest Miramichi River smolt wheel were marked with streamer tags bearing the individual numbers between the series

B50,000 and B51,062. Of the 1,061 smolts tagged, transported upstream, and released to the river, 28 were recaptured among the 1,170 first time captures of smolts at the RST (Table 8). This equated to a recapture rate of 2.7% for this wheel in 2011. The abundance of smolts emigrating from the Northwest Miramichi River in 2011 was estimated to be 44,200, with lower and upper confidence intervals of 32,400 and 68,600, respectively (Table 4). This estimate equates to approximately 1.2 (0.9-1.8) smolts per 100 m^2 of fluvial habitat in the Northwest Miramichi River. The abundance of smolts estimated in 2011 should be considered a minimum estimate as the wheel was raised for a few days when smolts were emigrating.

The majority (93%) of recaptured smolts had been tagged and released the previous day (Table 5). The maximum amount of time between the release and recapture date was four days (1 smolt).

Smolts captured in the Northwest Miramichi wheel ranged in fork length from 10.0 to 16.8 cm (Fig. 5). The average fork length in 2011 was 12.0 cm and 90% of the smolts were between 10.5 and 13.5 cm (Fig. 3). In 2011, the Northwest Miramichi River smolt run was comprised of 61% two year olds, 38% three year olds, and 1% four year olds, a contrast to the primarily age-3 smolts from the Little Southwest Miramichi and Big Sevogle rivers (Table 6). Only two smolts of hatchery origin were intercepted in the Northwest Miramichi smolt wheel in 2011, however, stocking efforts have shifted from primarily adipose-clipped fall fingerlings to unmarked two week old first feeding fry.

Big Sevogle River RST at mouth

The Big Sevogle River RST began operation on May 2, 2011 but was raised for seven days between May 4 and May 10 due to a high water event which damaged the wheel. The RST was reset on May 11 and operated daily until June 4, 2011 (Table 1).

Eight species of fish representing five different families were captured at the RST on the Big Sevogle River in 2011 (Table 9). Captures of all fish totaled 1,451 of which 63% were salmon smolts. Aside from Atlantic salmon the most commonly caught fish was Rainbow smelt (n = 224).

Catches of salmon smolts in the Big Sevogle RST were minimal until May 19, but peaked twice before the end of the run. The first peak occurred on May 21 (n = 182) then again on May 30 (n = 157). It does not appear that many smolts emigrated prior to water temperatures achieving a daily mean of 7°C on May 19 (Fig. 2).

The majority (91%) of smolts captured in the Big Sevogle River smolt wheel were marked with streamer tags bearing the individual numbers between the series B39,001 to B39,821. Of the 817 smolts tagged, transported upstream, and released to the river, 13 were recaptured among the 901 first time captures of smolts at the RST (Table 10). This equated to a catch efficiency of 1.6% for this wheel in 2011. The abundance of smolts emigrating from the Big Sevogle River in 2011 was estimated to be 56,800, with lower and upper confidence intervals of 37,200 and 114,600, respectively (Table 4). This estimate equates to approximately 2.0 (1.3-3.9) smolts per 100 m^2 of fluvial habitat in the Big Sevogle River. The abundance of smolts estimated in 2011 should be considered a minimum estimate as the wheel was raised for a few days when smolts were emigrating.

The majority (85%) of smolts tagged and released at the upstream location were recaptured at the RST on the following day, with the additional 15% (2 smolts) of smolts being recaptured after 4 or 7 days (Table 5).

Smolts ranged in size from 10.0 to 17.6 cm (Fig. 6). The average fork length in 2011 was 12.1 cm and 90% of the smolts were between 10.5 and 13.5 cm (Fig. 6). In 2011, the Sevogle River smolt run was comprised of 33% two year olds, 61% three year olds, and 6% four year olds. Only one smolt of hatchery origin was intercepted in the Big Sevogle smolt wheel in 2011 (Table 6).

Cassilis smolt trapnet

The Cassilis smolt trap operated from May 17 (first catch May 18) to June 10, 2011 without interruption (Table 1).

Eleven species of fish representing seven different families were captured at the Cassilis smolt trap in 2011 (Table 11). Captures of all fish totaled 53,296 of which 16% were salmon smolts. The most commonly captured fish was rainbow smelt (n = 42,042), followed by Atlantic salmon smolts (n = 9,964) and striped bass (n = 861) (Table 11).

Atlantic salmon smolts were captured each day that the trapnet was operating. There were two peak catches during the run, the first on May 21 (n = 3,680) and the second on May 27 (n = 1,996). Catches of smolts before and after each peak were relatively low with the majority of the run occurring over an eight day period between peak catches. Smolt catches between May 29 and 31 are considered incomplete as many are believed to have escaped due to large holes discovered in the net and then from evading the net all together due to improper mending and setting. It does not appear that many smolts entered the estuary prior to May 19 when water temperatures achieved a daily mean of 11°C. The majority of smolts were captured at the Cassilis trapnet when water temperatures were between 12-15°C (Fig. 7).

Of the 2,914 smolts tagged, transported upstream, and released to the river above the smolt wheels, 33 smolts were recaptured at the Cassilis trapnet out of 9,564 smolts (Table 12). The efficiency of the trapnet at capturing smolts was estimated to be 1.3%. The recapture efficiency at the Cassilis trapnet for smolts tagged at each of the individual wheels was identical (1.3% for the Little Southwest, 1.1% for the Big Sevogle and 1.0% for the Northwest Miramichi). The estimated abundance of smolts emigrating from the Northwest Miramichi system (all tributaries combined) in 2011 was 768,000, with lower and upper confidence intervals of 576,000 and 1,137,000, respectively. This estimate equates to approximately 4.6 smolts per 100 m^2 (Table 4).

There was a large discrepancy between the estimates of emigrating salmon smolts from the Northwest Miramichi system in 2011 depending upon the design of the mark and recapture experiment. Specifically, the smolt estimate generated from the estuarial trapnet information was four and half times higher than the sum of the estimates generated from each of the three smolt wheels located on the main tributaries (768,000 versus 168,900). The estimate generated from the estuarial trapnet is considered to be more credible because weather and water conditions in 2011 required the wheels to be lifted which precluded the complete sampling of the individual smolt runs. It is unknown what portion of the smolt run was missed during these periods of interruption but was likely significant during the high water events.

The majority (80%) of smolts tagged and released at the upstream location were recaptured at the estuary trap within six days (Table 5). The highest number of smolts (n = 11) was recaptured three days after being tagged and released above the smolt wheels. The maximum amount of time between the release and recapture date was 12 days (1 smolt) (Fig. 8).

The sex ratio of smolts sampled from the Cassilis trapnet was 58% male and 42% female (Table 6). Smolt fork lengths taken from fresh samples ranged from 10.5 to 19.0 cm with an average fork length of 13.5 cm. Ninety percent of the smolts measured between 11.5 and 15.5 cm (Fig. 9). The average whole weight after thawing was 18.1 g (range 6.5 – 37.1 g) and the power function Weight = 3×10^{-5} * length $^{2.749}$ provided a good fit (r^2 = 0.87) to the raw length and weight data collected from smolts that were sacrificed for biological information (Fig. 4). The dominant age class of smolts was age two (61%), followed by age 3 (38%), and age 4 (0.4%) (Table 6). Eleven smolts of hatchery origin (0.1% of samples) were intercepted in the Cassilis trapnet in 2011.

INDEX TRAPNET MONITORING PROGRAM

The use of index trapnets to monitor the returns of Atlantic salmon and many other species to the Miramichi River has continued annually since 1954 (Chaput 1995, Claytor 1996). During most of this time (1954 – 1992) a single trapnet was operated in the main Miramichi River at Millbank (Claytor 1996). The desire to have separate estimates of salmon returns to each of the Northwest and Southwest Miramichi Rivers has resulted in the operation of additional trapnets in each of those major tributaries over the years and partnerships with both Eel Ground and Metepenagiag First Nations (Moore et al. 1992; Courtenay et al. 1993; Chaput et al. 1994). In 1994, DFO's index trapnet on the Southwest Miramichi was moved up river again to Millerton and has operated there annually since (Fig. 1). Similarly in 1998, DFO's index trapnet program expanded into the Northwest Miramichi River with the operation of a trapnet at Cassilis which has operated there annually since (Fig. 1).

METHODS

Cassilis Trapnet – Northwest Miramichi River

The DFO index trapnet on the Northwest Miramichi was installed in its regular location at Cassilis in 2011 (see methods section of smolt program above) (Fig. 1). The Cassilis trapnet is located on the south side of the river about 17 river kilometres above the confluence of the Northwest and Southwest Miramichi rivers. In 2011, and similar to other years when a smolt estimate for the Northwest Miramichi system was desired (1998-2006), the framework for the trapnet was installed earlier than normal, with a more elaborate structure of extra pickets and brail to accommodate the adult trapnet once the smolt run was completed. When the smolt run was over, the smaller meshed net was removed and replaced with a larger meshed net (4.3 m deep, 3.4 m wide, 18.3 m long, and stretch mesh size of 22 mm) with a back channel (same since 1998). The frame was designed so the existing leader would intersect the large meshed net on the upstream side of the 3 m wide opening for the door so fish ascending the river would be captured. The leader net was also switched to a polypropylene knotted mesh with a stretch size of 152 mm. The leader was 4.3 m at its' deepest, tapered to 1 m near shore, and remained in contact with the river bottom when set.

The Cassilis trapnet was checked daily, usually near low tide. Records on date, time of day, cloud cover, general weather conditions, secchi depth, water temperature, and crew members were taken daily. At a minimum, all fish were identified to species, counted, and released to the wild (white suckers, white perch, fallfish, and sea lamprey). All brook trout and American eels were measured for length (nearest 1 mm). When catches numbered ten or fewer, all striped bass and American shad were measured for fork length, checked for sex, and had scales removed to determine age. When catches of striped bass were greater than ten, more fish were often sampled to obtain a better representation of the biological characteristics of the catch. Unless gaspereau catches were very low (20 individuals or less), their abundance was always estimated. During the gaspereau run, approximately 80 individuals were identified to species (alewife or blueback herring) and measured every other day.

Small, light blue, Carlin tags identifying a unique number sequence on one side and the DFO's address on the other were applied to a daily maximum of 30 large and 30 small salmon. All salmon that were tagged were measured for fork length and examined for sex, the presence of an adipose fin (indicates wild and not hatchery origin), sea lice load (categories of none, <5, 5-15, 16-50, >50), scars, and scale sampled to determine age. When water temperatures increase to the point where salmon become stressed, the sampling protocol changed depending on the severity of the event and ranged from sampling without tagging, to just counting, to dropping the net and allowing the fish to swim out freely without manipulation, to lifting the net all together. In 2011, all small salmon were released without sampling on July 12, and were sampled but not tagged on July 13. All large salmon were sampled without tagging on the same two days in 2011.

Millerton Trapnet – Southwest Miramichi River

The DFO index trapnet on the Southwest Miramichi River was installed in its regular position at Millerton on the north side of the river about 11.5 river kilometres upstream of its confluence with the Northwest Miramichi River (Fig. 1). The trapnet was positioned in the same location as in 2010, approximately 25 m up-river from its historical (1994-2009) position. The framework of the Millerton trapnet measured 18 m long by 3.4 m wide and consisted of a series of wooden pickets driven into the river bottom which were secured with horizontal wooden brail and anchoring systems. The leader was constructed similarly, extended 46 m from shore, and intersected the trap near its' center. The net of the trap was constructed of knotless nylon mesh (51 mm stretched) and measured 18 m long, 3.4 m wide, 5.2 m deep, and was designed with a back channel (same since 2001). The net used for the leader was constructed of polypropylene knotted mesh (152 mm stretched) and measured 46 m long, 5.2 m deep at the trap and tapered to 1.5 m at the shore. The leader remained in contact with the river bottom during fishing and intersected the trap on the upstream side of the 3 m wide door opening so fish ascending the river could be captured.

The trapnet procedures and fish sampling protocols used at Millerton in 2011 were identical to those at Cassilis (see above). There was one occasion at Millerton in 2011 (July 13) when 14 small salmon were released without sampling because of increased water temperatures.

RESULTS

Cassilis Trapnet – Northwest Miramichi River

The larger meshed net was installed on June 12 and operated daily until October 21 when it was removed for the year. High water events required the trapnet to be lifted on two occasions (June 18 and August 28) for a total of five non-fishing days. The trapnet at Cassilis was fished for a total of 125 days in 2011 and captured approximately 13,000 fish representing 11 species and seven families (Table 13).

Gaspereau

The majority (84%) of the fish caught at the Cassilis trapnet in 2011 were gaspereau. The first catches of gaspereau occurred between May 21 and June 10 in the small meshed net used to capture emigrating Atlantic salmon smolts (Table 11). Due to the trapnet's configuration to capture fish descending the estuary, we assume it had a lower capture efficiency for gaspereau (and any other fish species) ascending the estuary at that time. The larger meshed trapnet at Cassilis captured gaspereau between June 14 and September 13 with 50% of the catch captured by July 2 and nearly 100% of the catch by July 26. The peak catch of approximately 1,400 gaspereau occurred on July 14 and likely represented spent fish descending the estuary (Fig. 10). By the time the large meshed net was installed at Cassilis, the proportion of alewives in the catch was decreasing while the proportion of blueback herring was increasing. Blueback herring continued to comprise the bulk of the gaspereau catch throughout the remainder of the run (Fig. 11). The average fork length of blueback herring was 251 mm (range 207-277), while alewives were on average smaller (mean 246 mm; range 217-272 mm) (Fig. 12). The mean fork length of both species decreased as the season progressed (Fig. 13).

American shad

American shad were captured almost daily at the Cassilis trapnet in June and July and 50% of the total catch was captured by June 17 (Fig. 14). The peak catch (n=43) occurred on June 14 and coincided with the first day of fishing with the larger meshed net. Shad were first captured at the Cassilis trapnet on June 1 when the smaller meshed net was being used for the smolt study (Table 11). Of the samples that had a positive sex identification, 18% were female and 82% were male. The sex of 34% of samples was unknown because sexual products could not be extruded when gentle pressure was applied to the abdomen. Male and female shad had a mean fork length of 419 mm (range 343-487) and 463 mm (range 422-502) respectively, and the mean fork length of all samples was 433 mm (343-502) (Fig. 15). The ages of the shad, determined from the interpretation of scales, ranged from 2 to 7 years with a mean age of 4 (Fig. 16).

Striped bass

Striped bass represented 1% of the total catch at Cassilis in 2011. A total of 861 striped bass (peak n =674 on May 28) were captured at the Cassilis location when the trapnet was configured to catch emigrating salmon smolts between May 27 and June 9 (Table 11). Striped bass were caught between June 14 (installation of large mesh net) and October 20 but catches were intermittent and negligible (total annual catch of 132, Table 13) (Fig. 17). Of the 14 adult striped bass captured during spawning time in June, 13 were male and the sex of the others couldn't be identified. The fork length of adult striped bass in June averaged 518 mm (range 350-703) and 553 mm in October (range

410-831 mm) (Fig. 18). Adult striped bass captured in the spring ranged in age from 1 to 9 years and were predominantly age 2 and 3 while ages from fish sampled in the fall ranged between 3 and 11 years with the majority aged 4 years old (Fig. 19).

American eel

Fourteen American eels were captured in the Cassilis trapnet between June 21 and August 17 in 2011 with the majority (57%) captured in July (Fig. 20). The total length of eels ranged between 585 mm and 855 mm and averaged 700 mm (Fig. 21).

Atlantic salmon

There were a total of 1,213 small salmon and 490 large salmon (i.e. ≥ 63cm fork length) enumerated at the Cassilis trapnet in 2011 (Table 13). The small salmon peaked from the last week of June to the middle of July with 50% of the annual catch occurring by July 7 and 85% by the end of July. The peak catch of large salmon occurred from July 5 to July 17. Fifty percent of the large salmon catch was counted at Cassilis by July 13 and 70% by July 31. Twelve percent of the small salmon and 21% of the large salmon captured at the Cassilis trap occurred from September 1 to the end of the sampling season on October 21 (Fig. 22).

The mean fork length of one sea -winter maiden salmon sampled at the Cassilis trapnet in 2011 was 56.2 cm and similar to previous years. For two sea-winter maiden salmon the mean fork length was 77.8 cm and also similar to previous years (Fig. 23). Small salmon sampled at the Cassilis trapnet in 2011 were predominantly male (90%) but this could be an inflated sex ratio due to the difficulty discerning small female salmon early in the season (many are identified as sex unknown). Identifying small female salmon becomes easier as the summer progresses and the kypes of the small male salmon grow and become more obvious. Discerning the sex of large salmon is not problematic at any time during the season. The large salmon catch at Cassilis in 2011 was 90% female and 10% male.

River ages from the scales of 763 small salmon were discernible with 46% having a river age of 2 and 53% age 3. Less than 1% had a river age of 4 (3 fish). Sea ages were discernible from the scales of 838 small salmon of which 99.8% were 1SW maiden fish. There were two small salmon (i.e. < 63 cm fork length) representing 0.2% of samples that had spawned previously (Table 14).

Scales removed from wild salmon in the large category (fork length ≥ 63 cm) at the Cassilis trapnet in 2011 were assigned river ages in the following proportions: 54% age 2 and 46% age 3. These river age proportions were also identical to the 2SW maiden component alone (n = 316). Sea age and previous spawning marks were discernible from the scales of 395 large salmon sampled at the Cassilis trapnet in 2011. The majority (88%) of large salmon were maiden 2SW fish, followed by repeat spawners (10%), and 1SW maiden fish (2%). There were nine different spawning histories identified from scales removed from large salmon at the Cassilis trapnet in 2011 (Table 15). The two oldest salmon had river ages of 2, sea ages of 5 and had spawned three times previously before returning to the river in 2011.

The number of sea lice on all Atlantic salmon sampled at the Cassilis trapnet in 2011 was estimated and categorized as either none, <5, 5-15, 15-50, or >50. The majority (80%) of all Atlantic salmon (one sea-winter and multi-sea-winter combined) sampled at Cassilis in 2011 had no sea lice, followed by those with <5 (12%), those with 5-15 (6%),

and those with 15-50 (2%). No fish had a lice load >50. Salmon and grilse (1SW) without sea lice represented the highest proportion of samples for each month between June and October (Fig. 24). Salmon and grilse captured during the month of August had the most even distributions of sea lice loads (Fig. 24).

Millerton Trapnet – Southwest Miramichi River

In 2011 the Millerton trapnet was installed on May 30 and was fished daily until October 21. Two high water events required that the Millerton trapnet be lifted for three days between June 19 – 21 and August 29 and 31. The Millerton trapnet was fished for a total of 136 days in 2011 and captured approximately 20,000 fish representing ten species, and six families (Table 16).

Gaspereau

The majority (57%) of fish caught at the Millerton trapnet in 2011 were gaspereau. Gaspereau were first captured on June 1 and nearly daily thereafter until early August. Catches were relatively small and variable throughout the run with the peak (n = 1,500) occurring on June 7. Fifty percent of the total catch of gaspereau at Millerton had occurred by June 15, and nearly 100% of the catch by July 22 (Fig. 10). Alewives comprised nearly 100% of the gaspereau run early in the season but had decreased to 50% by June 12. This also coincided with an increase in the blueback herring proportion which remained between 60-80% for the remainder of the run (Fig. 11). The average fork length of blueback herring was 248 mm (range 197-282) and the same as that of the alewives (mean 247 mm; range 222-292 mm) (Fig. 12). The mean fork length of both species decreased as the season progressed (Fig. 13).

American shad

American shad were captured almost daily at the Millerton trapnet between June 1 and August 1 in 2011. The peak catch (n=47) occurred on June 15 and 50% of the total catch was captured by June 16 (Fig. 14). Of the samples that had a positive sex identification, 9% were female and 91% were male. The sex of 34% of samples was identified as unknown because sexual products could not be extruded by applying gentle pressure to the abdomen. Male and female shad had a mean fork length of 428 mm (range 354-538) and 469 mm (range 436-513) respectively, and the mean fork length of all samples was 441 mm (range 273-538) (Fig. 15). Shad ages ranged between 2 and 8; males were predominantly (50%) age-4 and females were predominantly (46%) age-5 (Fig. 16).

Striped bass

Striped bass represented 26% of the total catch at Millerton in 2011. Striped bass were captured on the first day of operation (May 31) and the last (October 21) (Fig. 17). The bulk of the adult striped bass were captured in June and October and coincided with spawning time in the spring and overwintering time in the fall. Catches of striped bass in July and August were predominantly of juvenile fish. The single highest daily catch of adult striped bass in the Millerton trapnet since it began operation in 1994 occurred on October 10, 2011 (n = 1,483) (Fig. 17). The striped bass catch during the spring spawning time in May and June was dominated by males (87%) and only 2% were identified as female. The sex of 11% of the spring catch was indiscernible (sexual products could not be extruded) and identified as 'unknown'. Similarly, the sex of all striped bass captured in the fall was unknown. Adult striped bass captured in May and June had a mean fork length of 418 mm (range 271-771), males averaged 413 mm (range 271-771), and females averaged 558 mm (range 465-662) (Fig. 25). The fork

lengths of adult striped bass captured in the fall ranged between 322 and 808 mm and averaged 529 mm. Adult striped bass captured in the spring had a mean age of 3.5 (range 3 to 11), males were predominantly aged 3 and 4 and females predominantly aged 4 and 5. Adult striped bass captured in the fall ranged in age from 3 to 11 with the majority aged 4 years old (Fig. 19).

American eel

Seventeen American eels were captured in the Millerton trapnet between May 31 and September 18 in 2011 with the majority (59%) captured in June (Fig. 20). The total length of eels ranged between 539 mm and 900 mm and averaged 669 mm (Fig. 21).

Atlantic salmon

There were a total of 2,086 small salmon and 761 large salmon enumerated at the Millerton trapnet in 2011 (Table 16). The catch of small salmon peaked during the second week of July with 50% of the annual catch arriving by July 11 and 84% by July 31. Similarly, the catch of large salmon also peaked during the second week of July with 50% of the annual catch occurring by July 14 and 71% by the end of July. Catches of small and large salmon during the fall run (after Aug. 31) accounted for about 16% and 22% of the yearly count at the Millerton trapnet (Fig. 22).

The mean fork length of small salmon sampled at the Millerton trapnet in 2011 was 56.5 cm and similar to previous years. For 2SW maiden salmon the mean fork length was 78.2 cm and also similar to previous years (Fig. 23). The sex ratio for small salmon at the Millerton trapnet in 2011 was 89% male and 11% female and for large salmon was 86% female and 14% male.

River ages from the scales of 1,092 small salmon sampled at the Millerton trapnet were discernible with 47% having a river age of 2 and 52% age 3. Less than 1% had a river age of 4 (5 fish). Sea ages were discernible from the scales of 1,191 small salmon of which 99.7% were 1SW maiden fish. There were three small salmon (i.e. < 63 cm fork length) representing 0.3% of samples that had spawned previously and consecutively (Table 17).

Scales removed from wild salmon in the large category (i.e. ≥ 63 cm fork length) at the Millerton trapnet in 2011 were assigned river ages in the following proportions: 53% age 2 and 47% age 3. Similarly, 50% of the 2SW maiden component alone had a river age of 2 and age 3. Sea age and previous spawning marks were discernible from the scales of 649 large salmon sampled at the Millerton trapnet in 2011. The majority (83%) of large salmon were maiden 2SW fish, followed by repeat spawners (14%), 1SW maiden fish (3%), and 3SW maiden fish (0.2%). There were 11 different spawning histories identified from scales removed from large salmon at the Millerton trapnet in 2011 (Table 18). The oldest salmon had a river age of 2, sea age of 7, and had spawned in each of the previous 6 years before returning to the river in 2011.

The majority (59%) of all Atlantic salmon (1SW and MSW combined) sampled at Millerton in 2011 had no sea lice, followed by those that had <5 (20%), those with 5-15 (15%), those with 15-50 (5%), and those with >50 (<1%, 4 fish). With the exception of salmon in August, salmon and grilse without sea lice represented the highest proportion of samples for each month between June and October (Fig. 24). Salmon and grilse captured during the month of August had the most even distributions of sea lice loads (Fig. 24).

ATLANTIC SALMON MARK AND RECAPTURE EXPERIMENT

The returns of both small and large adult salmon to the Miramichi River and its two major branches have been estimated with mark-recapture experiments since 1992. The DFO's trapnet monitoring program (see above) provides the platform from which small and large salmon can be captured, tagged, released, and potentially recaptured in another trapnet higher in the estuary or one located in the other major branch. The mark recapture experiment also relies heavily on the information collected from salmon and grilse captured in trapnets operated by Eel Ground and Metepenagiag First Nations. As part of the Aboriginal Fisheries Strategy program, Eel Ground and Metepenagiag First Nations have operated trapnets annually in the Northwest and Southwest Miramichi estuaries since 1985, and 1994 respectively. The main function of these trapnets is to provide the First Nations communities with Atlantic salmon for food, social, and ceremonial purposes but they also serve as important locations where salmon and grilse are tagged, released, recaptured, and sampled for biological characteristics.

METHODS

DFO Index trapnets – Millerton and Cassilis

The trapnet and fish sampling procedures for Atlantic salmon were described above in the Index Trapnet Monitoring Program section.

Eel Ground First Nation Trapnets – Southwest Miramichi River

Eel Ground First Nation operated two trapnets in 2011 and both were located in the Southwest Miramichi River just above its confluence with the Northwest Miramichi River (Fig. 1). These traps have been identified as Eel Ground Enclosure (lower) and Eel Ground above the railroad (RR) bridge (upper) (Table 1, Fig. 1). The lower trapnet was positioned about 300 meters down-river from its' historical location (1992 – 2010) in 2011. The trapnets are of a T-trap design and configured similarly to the index trapnets used by DFO Science to catch fish moving upstream. During the month of June, these trapnets were used for the catch and commercial sale of gaspereau and all by-catch was released. On July 1, the trapnets began operating according to an AFS agreement and were used to catch salmon and grilse for food and science.

Generally, the trapnets operated by Eel Ground First Nation were fished daily. Similar to DFO's procedure at index trapnets, the majority of large salmon were tagged with a Carlin tag, measured for fork length, and examined to determine sex, origin, and sea lice loads. While some grilse were also tagged, assessed for biological characteristics, and released to the river, the majority were harvested for food and little data was collected on this harvested component. All other species in the catch were identified, counted, and released.

Metepenagiag First Nation Trapnets – Northwest Miramichi River

Metepenagiag operated two trapnets at their regular locations in 2011. One trapnet at Red Bank is located in the Northwest Miramichi River on the south side (Little Southwest Miramichi River side) just below the Rt. 425 highway bridge. The other trapnet at Red Bank is located in the Northwest Miramichi River on the north side of the river approximately 350 m above the Rt. 425 highway bridge. Once installed, the trapnets were generally fished once a day, five times a week between Monday and Friday

inclusive. The trapnets were lifted on Friday after being fished and reset the following Sunday to be checked on Monday.

The majority of salmon and grilse intercepted in the trapnets operated by Metepenagiag First Nation were harvested for food. All harvested fish were measured for fork length, weighed, sexed, examined for a Carlin tag and adipose fin, and scale sampled for ageing purposes. Large and small salmon that were released from the trapnet were counted and examined for the presence of a Carlin tag. All other fish captured in the trapnets were identified to species, counted, and released to the river.

RESULTS

DFO Index trapnets – Millerton and Cassilis

Carlin tags were applied to 840 and 1,207 small salmon at the Cassilis and Millerton trapnets respectively in 2011 (Table 19 and Table 20). The majority of large salmon captured at both trapnets were also tagged before their release (399 at Cassilis and 641 at Millerton) (Table 21 and Table 22). The 2011 Carlin tag series ranged between YY22438 and YY35722 (Table 23). The Millerton trapnet recaptured 81 small and 25 large salmon in 2011 but only 16 small (6 from Cassilis and 10 from Eel Ground) and 10 large (3 from Cassilis and 7 from Eel Ground) satisfied the rules of the Bayesian hierarchical model used to derive population estimates (Chaput and Douglas 2012). Recaptured salmon that counted at the Cassilis trapnet totalled 7 small (3 from Millerton and 4 from Eel Ground) and 8 large (7 from Millerton and 1 from Eel Ground) (Table 24).

Eel Ground First Nation Trapnets – Southwest Miramichi River

The lower trapnet operated by Eel Ground First Nation began fishing for salmon on July 3 and operated until August 23 for a total of 40 fishing days in 2011. The trapnet was lifted on three occasions (July 31, Aug. 7 and Aug.15) for a total of 12 days as a result of an increase in water temperature and few salmon running. The total catch from this trapnet was almost 2,600 fish and was composed of eight different species (Table 25). A total of 388 small salmon and 158 large salmon were counted at this trapnet, and of these, 77 small salmon and 143 large salmon were tagged and released for potential recapture. The majority of salmon counted at the trapnet was during the month of July with the peak day for small and large salmon occurring on July 6 (Fig. 26).

The upper trapnet (above RR bridge) began fishing for salmon on July 2 and operated until September 15 for a total of 63 days. The trap was brailed on July 16 -17 as a result of an increase in water temperatures and from Aug. 26 – Sept. 5 resulting from high water discharge. The total catch exceeded 4,200 fish and was composed of ten different species (Table 25). Catches of small salmon totalled 732 and of these 181 were tagged with Carlin tags and released to the wild. The large salmon catch was 409 of which 272 were tagged (Fig. 26).

Metepenagiag First Nation Trapnets – Northwest Miramichi River

The Northwest trap at Red Bank was installed on July 27 and operated until August 7 when it was damaged from a high water event. The trapnet was not operational again until August 21. On August 29 the trap sustained additional damage from post-tropical storm Irene and the trap was removed from the river for the rest of the season. The trapnet was only fished on seven occasions and resulted in the capture of 23 fish which comprised five different species (Table 26). Four small and one large salmon were captured in this trapnet and none carried a Carlin tag.

The Little Southwest trapnet was installed on June 28 and remained operational until September 15. It fished for a total of 53 days in 2011. As a result of high water, the trapnet was brailed for extended periods of time on two occasions, once in early August and again during the last week of August and into September for a total of 25 days. The Little Southwest trapnet caught ten different species of fish which combined for a total of just under 4,000 individuals (Table 26). The total catch of small salmon was 395, and large salmon was 262 (Fig. 27). Sixteen small salmon were recaptured at this location that had been tagged at the Cassilis (n= 12), Millerton (n = 2) and Eel Ground upper (n= 2) trapnets. Ten large salmon were recaptured at this location that had been originally tagged at Cassilis (n=9) and Eel Ground upper (n=1) trapnets (Table 24).

Estimates of Atlantic salmon returns

The catch, tagging, and recapture information (above) from small and large salmon captured in Miramichi trapnets has been modelled in a hierarchical Bayesian framework to derive estimates of returns to the Miramichi River and its branches (Chaput and Douglas 2012). The mean estimate of small salmon returns to the Northwest Miramichi River in 2011 was 13,550 with 95% confidence intervals (CI) ranging between 9,976 to 18,680 fish (Chaput and Douglas 2012). Small salmon returns to the Northwest Miramichi River were slightly lower than 2010 but among the highest since 1994. The large salmon mean return estimate for the Northwest Miramichi River was 5,147 with 95% confidence intervals ranging between 3,180 to 8,813 fish (Chaput and Douglas 2012). This is the second highest return estimate for large salmon in the last 14 years.

The mean estimate of returns for small salmon to the Southwest Miramichi River in 2011 was 31,710 with a 95% confidence interval range of 22,360 to 45,890. This is slightly lower than in 2010 but the second highest return estimate since 1994. The large salmon mean return estimate was 27,870, (17,140 to 58,150 95% CI) and was among the highest returns since the 1970's (Chaput and Douglas 2012).

Angler Tag Returns in 2011

Anglers are encouraged to remove and return Carlin tags or record their numbers from Atlantic salmon that they capture throughout the season. Tags are returned to DFO's address on the back side of the Carlin tag and are usually accompanied by the date and location that the fish was angled. DFO Science sends a response to the angler indicating the purpose of the mark and recapture program, the date, location, size, and sex of the fish at the time of tagging (Appendix 1). Anglers that return tags and catch information are entered into a draw for monetary prizes that the North Atlantic Salmon Conservation Organization (NASCO) administers.

Carlin tags encountered by anglers during the 2011 fishing season numbered 118; 71% were from 1SW salmon at the time of tagging and 29% from MSW salmon. The number of tag returns was the highest from those applied at the Millerton trapnet (n=56), followed by the Cassilis trapnet (n=44), and finally from the two trapnets operated by Eel Ground First Nation (n=18). The majority of tags returned in 2011 were from fish tagged in 2011 (75% of 1SW tag returns, and 62% of MSW tag returns), while fish tagged in 2010 (24% of 1SW; 35% of MSW) and 2009 (1% of 1SW; 3% of MSW) made up the rest. Tag returns in 2011 from salmon tagged in 2010 were largely from the spring kelt fishery. A large proportion of both 1SW and MSW salmon tagged at the Cassilis facility on the Northwest Miramichi were recaptured at some location within the Southwest Miramichi or one of its tributaries (Table 27). The exchange of salmon tagged on the Southwest

Miramichi that were recaptured on the Northwest Miramichi or one of its tributaries was less frequent (Table 28).

HEADWATER PROTECTION BARRIERS

The New Brunswick Department of Natural Resources (DNR) operates a barrier in a headwater location on the Northwest Miramichi and Dungarvon rivers. These barriers have operated annually since 1988 (Northwest Miramichi) and 1984 (Dungarvon). The refuge area is blocked off by an upstream and downstream framework of rails, conduit, and supports that extend from bank to bank. These fences are not passable by salmonids. Atlantic salmon and brook trout are counted through the lower fence and permitted to take refuge inside the barrier until water levels increase in the fall and protection is no longer deemed necessary. Once the barriers are removed, salmon and trout seek suitable spawning locations in the area.

From 1984 to 1999, DNR operated a third protection barrier on the North Branch of the Southwest Miramichi River near Juniper. In 2000, JD Irving took over the operation of the barrier with additional financial support from the Miramichi Watershed Management Committee. Up until to 2009, this facility was operated as a protection barrier for Atlantic salmon and trout near the headwaters. In 2010 and 2011 the Juniper facility was operated as a counting fence only as the lower fence was installed without the upper fence in place to contain fish.

RESULTS

In 2011, the Northwest barrier was operated daily from June 1 to October 20. The first Atlantic salmon (grilse) was counted through the fence on June 7 and the last on October 20. Fifty percent of the barrier's annual catch for both salmon and grilse occurred by mid July (Fig. 28). A significant movement of grilse (n=124) occurred on October 15 and is likely attributable to a rain event on the previous day which raised the water level considerably. At the end of the season, the Northwest barrier had provided refuge to 996 grilse, 298 salmon, nearly identical numbers as in 2010 (Dubee et al. 2011) (Fig. 29).

The Dungarvon barrier operated daily between June 2 and October 20. The first Atlantic salmon was counted through the fence on June 3 and the last on October 19. Fifty percent of the barrier's annual catch for both salmon and grilse had occurred by July 12 (Fig. 28). The highest daily catch of 47 grilse on October 15 (same as NW barrier) coincided with a rainfall event and increased water level on the same day. The Dungarvon barrier provided refuge to 712 grilse and 327 salmon in 2011; nearly identical levels as in 2010 (Dubee et al. 2011) (Fig. 29). The catch of large salmon in 2011 was the highest of the Dungarvon barrier time series (1984 to 2011) (Table 29).

In 2011, the Juniper counting fence operations began on July 5, about 4 – 5 weeks later than most previous years, a consequence of high water. Another high water event required lifting the conduit on August 29 but was back in operation by September 1. Seven small and six large salmon were counted at the fence on July 6; one day after the fence was operational. A total of 381 large salmon were counted at the fence in 2011 which was down 32% from 2010 and the second lowest number recorded for large salmon since the operation of the fence began in 1984 (Table 29). Small salmon (n =

268) were also down 13% from 2010, and represented the third lowest number for small salmon since the operation of the fence began. Fifty percent of the small and large salmon arrived at the barrier by the third week of July (Fig. 28 and 29). Counts for 2010 at the Juniper fence are considered incomplete because it was not operated for a period of time through the summer months during that year. As a result of the late start and days that the counting fence was not operating, the counts for 2011 are also considered incomplete (Fig. 29).

ELECTROFISHING SURVEYS OF THE MIRAMICHI WATERSHED

Electrofishing surveys of the Miramichi watershed have been conducted annually since 1970 with the main objective of evaluating the abundance and freshwater habitat use of juvenile salmon (Moore and Chaput 2007). Electrofishing involves emitting an electrical current into the water which causes the fish to be temporarily stunned and captured for sampling.

METHODS

The sites surveyed in 2011 were the same as those that have been consistently surveyed for many years. The sites were generally fished from bank to bank by wading back and forth across the stream and shocking an area up to 3 m long by 1 m wide with each individual sweep. On occasions when water levels were too deep to permit the sampling of the complete cross section of the river, the offshore border of the site was determined by the depth of water that still permitted an efficient electrofishing technique. One crew member operated the backpack electrofisher, while the other two members caught the disoriented fish with a lip seine or dip net and placed them in a bucket. The sites were electrofished until at least 500 seconds of shocking effort had been achieved. In 2011, the backpack electrofishing unit was a Smith Root Model 12B and the settings were generally a frequency of 60 Hz and a voltage of 500. The settings on the electrofishing unit were adjusted at each site according to the conductivity of the water.

All fish captured were anesthetised with clove oil (1 part clove oil to 9 parts alcohol) identified to species and counted. A maximum of 50 of each species or life stage was measured for fork length (nearest 0.1 mm) and weighed (nearest 0.1 g). All fish were given time to regain consciousness before they were released back into the site. Site measurements included length, width, gradient, maximum depth, and depth at nine places throughout the site (25%, 50%, and 75% of the stream width at the lower, middle, and upper limits of the site). Habitat measurements included water temperature, conductivity and visual estimates of the percent run, riffle, pool, flat, the substrate type (range from fine silt to bedrock), and the amount of overhanging vegetation.

Similar to previous years, two procedures were used to survey the electrofishing sites. One method consisted of placing a barrier net at the upper and lower extents of the site so neither immigration nor emigration of fish into or out of the site was possible. The other method consisted of electrofishing an open site without barrier nets. The area of the closed sites was electrofished four times with the first sweep in the upstream direction and subsequent sweeps in the downstream direction. Open sites were electrofished with one sweep of the area in a downstream direction. The abundance of juvenile salmon at closed sites was estimated using the depletion method described by Zippin (1956). The linear relationship between the catch and effort data collected on the

initial upstream sweep of the closed site and the subsequent abundance estimate derived from the depletion of the same site provided a correlation with which juvenile salmon abundance at open sites could be estimated (Chaput et al. 2005). Similar to Chaput et al. (2010), results were summarized by the four large rivers of the system (Southwest Miramichi, Northwest Miramichi, Little Southwest Miramichi, and Renous rivers).

RESULTS

As a result of high water from post-tropical storm Irene, electrofishing surveys in 2011 began on September 9, a week later than scheduled. The survey continued without interruption until September 30. In 2011, 49 sites (47 open and 2 closed) were sampled which was lower than the previous ten year average of 68.

A total of 26 sites were completed on the Northwest Miramichi system and the majority of the sites were sampled from bank to bank (69%) (Fig. 30). On average, the type of habitat surveyed in the Northwest Miramichi system was predominantly characterized as run (69%) followed by riffles (22%) (Fig. 30). The bottom substrate of sites sampled in the Northwest Miramichi watershed was predominantly cobble (29%), pebble (20%), rock (19%), and gravel (15%); the preferred habitat of juvenile salmon (Moore and Chaput 2007). The elevations of the sites surveyed in 2011 ranged from 5 m above sea level at sites near the estuary to 300 m at headwater sites. Stream orders of the sites ranged from 2 to 6 with the majority of sites (46%) having a stream order of 4 (Fig. 30).

In the Southwest Miramichi river system, 23 sites were surveyed with the majority (87%) sampled in a bank to bank fashion (Fig. 31). The type of habitat sampled in sites located in the Southwest Miramichi system consisted entirely of run (71%) and riffle (29%) (Fig. 31). The bottom substrates of sites sampled in the Southwest Miramichi were predominantly cobble (39%), pebble (23%), and rock (18%) (Fig. 31). Elevations of sites in the Southwest Miramichi system ranged from 12 m to 313 m above sea level and the stream order of sites ranged from 3 to 6 with the majority (53%) being order 4 (Fig. 31).

Salmon fry (age 0+) were found at all electrofishing sites but one (Barnaby River at West Collette) in 2011 which suggests that adult Atlantic salmon were successful at spawning throughout the Miramichi watershed in 2010. Estimates of fry abundance at sites were variable and ranged between 0 and 195 per 100 m^2 (Table 30). When fry abundance was averaged for sites within the four large rivers, densities were similar and ranged between 44 per 100 m^2 on the Little Southwest Miramichi to 64 per 100 m^2 on the Southwest Miramichi (Douglas et al. 2013). The trend in fry abundance over the last 15 years has been declining in each of the four large rivers but average densities continue to be higher than those observed prior to 1984 when the commercial fishery was still active and anglers could retain large salmon (Figs. 32 and 33). Average fork lengths of fry at sites sampled in 2011 ranged between 47 and 67 mm and average weights ranged between 1.2 and 3.0 g (Table 31). The average condition factor; a measurement determined from the length (cm) and weight (g), for fry was the same (range between 1.0 – 1.2) across all sites sampled in 2011 (Table 31).

Estimates of small (age 1+) parr densities varied considerably (range 0 – 84 small parr per 100 m^2) among sites sampled in 2011 (Table 30). When the estimates of small parr abundance were averaged for sites within the four large rivers, the lowest small parr abundance was observed in the Little Southwest Miramichi (13/100 m^2) and Southwest

Miramichi (14/100m^2) rivers. Small parr abundance was higher in the Renous (26/100 m^2) and Northwest Miramichi (32/100 m^2) rivers (Douglas et al. 2013). The trend in small parr abundance over the last 15 years has been declining in each of the four large rivers but average densities continue to be higher than those observed prior to 1984 when the commercial fishery was still active and anglers could retain large salmon (Figs. 32 and 33). The average fork lengths of 1+ parr sampled at sites in 2011 ranged between 79 and 102 mm while average weights ranged between 5.8 and 12.0 g. The average condition factor for 1+ parr (1.1 – 1.3) was the same across all sites sampled in 2011 (Table 31).

Estimates of large (age 2+) parr ranged between 0 and 29 per 100 m^2 at sites sampled in 2011 (Table 30). When the estimates of large parr were averaged for sites within the four large rivers, they were similar and ranged between 4/100 m^2 on the Little Southwest Miramichi River to 7/100 m^2 on the Northwest Miramichi River (Douglas et al. 2013). There has been an increasing trend for large parr in each of the four large rivers over the last 15 years (range from 37% increase in the Little Southwest Miramichi to 170% in the Renous river; Figs. 32 and 33). The average large parr densities in 2011 were at or above the long term mean for their respective rivers since the implementation of new management measures in 1984 (Douglas et al. 2013). The average fork lengths of 2+ parr sampled in 2011 ranged between 105 and 134 mm, while total weight ranged between 12.4 and 28.4 g (Table 31). The average condition factor of 2+ parr sampled at all sites in 2011 was the same and ranged between 1.0 and 1.1 (Table 31).

Estimates of total biomass at sites ranged between 39 and 1,142 g / 100 m^2 in 2011 (Table 30). When biomass estimates were averaged for sites within the four large rivers, they were similar and ranged from 250 g / 100 m^2 on the Little Southwest Miramichi to 450 g / 100 m^2 on the Northwest Miramichi River and remained unchanged and equivalent to the long term average between 1986 and 2011 for each of the four major rivers (Douglas et al. 2013). The trend in biomass over the last 15 years has been decreasing in the Southwest and Little Southwest Miramichi rivers but increasing in the Northwest Miramichi and Renous rivers (Fig. 34).

Estimates of total percent habitat saturation (PHS), (Grant and Kramer 1990) ranged from 3 to 79% at sites in 2011 (Table 30). The average PHS estimates for sites within the four large rivers were 17 for the Little Southwest Miramichi, 24 for the Southwest Miramichi, 26 for the Renous, and 30 for the Northwest Miramichi. These values were similar to previous years. Total percent habitat saturation for juvenile Atlantic salmon for the last fifteen years shows a decline on the Southwest, Northwest and Little Southwest rivers and a slight increase on the Renous river (Fig. 35).

Other than Atlantic salmon, nine additional fish species (American eel, blacknose dace, brook trout, common shiner, lake chub, sea lamprey, slimy sculpin, stickleback spp., and white sucker) were also collected and sampled at most electrofishing sites in 2011. The total catch and biological characteristics of these species are presented in Table 32.

FRESHWATER TEMPERATURE MONITORING PROGRAM

Monitoring water temperatures with in-river data loggers (Vemco Minilog8) began in the Miramichi watershed in 1997 as part of a climate change initiative. There was interest by some of the outfitting camps early in the program and they helped with the purchase and

maintenance of the equipment. Temperature recorders were generally placed at accessible locations with an attempt to cover most of the watershed. The sites have remained relatively consistent over the program with some locations retired for various reasons and others added (or have changed due to changing programs, priorities etc.). The data collected from this monitoring program was recently used to characterize the water temperature profile of the Miramichi watershed across time and space to inform management decisions for the Atlantic salmon angling fishery (DFO 2012, Caissie et al. 2013).

METHODS

Before deployment, temperature loggers were placed in an open-ended, 40 mm diameter x 300 mm long ABS plastic tube to protect them from debris and ice flows. The recorders were tethered with a length (1.5 m) of chain to a metal spike that was driven into the river bottom at locations deep enough to keep the unit submerged during summer low flow conditions. Mini loggers were configured to record a water temperature continuously every one or two hours (Table 33). The data were generally downloaded once a year during the fall months but this was dependent upon water levels and conditions. On occasions when the recorders could not be retrieved they remained in place until the following year when conditions permitted their retrieval.

RESULTS

A total of 21 temperature data loggers were retrieved and downloaded from various locations throughout the Miramichi watershed during the autumn of 2011. Sixteen of the data loggers had been deployed in 2009 and the other five deployed in early May of 2011 on various fishing gears that were used to monitor diadromous fish abundance (Table 33).

Water temperatures in 2011 generally followed the same trend at each location where they were monitored in the Southwest and Northwest Miramichi watersheds. The general pattern was an increasing trend in May and June, achieving a maximum in July, and then a progressive decrease until the data logger was removed in the fall (Figs 36, 37, 38). The maximum temperatures were recorded between the July 11 and 23 period for both the Southwest and Northwest Miramichi watersheds (Figs 37, 38). The maximum temperature recorded (26.3°C) from all the sites in 2011 was from the Taxis River on July 19 (Fig. 38).

COMMERCIAL GASPEREAU FISHERY SAMPLING PROGRAM

The spring spawning migration of gaspereau (alewife, *Alosa pseudoharengus* and blueback herring, *Alosa aestivalis*) to the Miramichi River has been exploited commercially since colonial times. In terms of both landings and effort, the gaspereau fishery of the Miramichi River is considered the largest in the southern Gulf of St. Lawrence (DFO 2001). The gaspereau fishery is concentrated at three main locations along the river which is also consistent with the locations where catches are landed. The lower most location is at Loggieville on the main Miramichi River, the middle location is at Chatham on the main Miramichi River, and the upper location is primarily in the Northwest Miramichi River just upstream of its confluence with the Southwest Miramichi River. Gaspereau are captured with a box type, double ended T- trap that is usually

positioned on the border of main river channels. Gaspereau are directed into the trapnet by a leader that extends perpendicularly from shore and intersects the trapnet in the center so fish ascending or descending the river can be captured. The catch is loaded live into a variety of vessels that range from open scows to lobster boats, transported to one of the three wharves where it is pumped into insulated plastic tubs or tanker trucks for transportation to packing plants.

Annual sampling of the Miramichi gaspereau fishery occurred between 1983 and 2005 (Chaput and Atkinson 2001). An effort to re-establish this sampling program occurred in 2011. In 2011 there were 21 active commercial licences and two active communal First Nation licences that fished a combined total of 33 trapnets in the Miramichi River and its two major branches.

METHODS

Catches of gaspereau from each of the three fishing areas were targeted for sampling twice per week during the fishing season (May 25 to June 22 for Loggieville and Chatham, May 30 to June 27 for the Northwest Miramichi). At the Loggieville and Chatham wharves, gaspereau that had already been purchased by the fish buyer were sampled. In the Northwest Miramichi River, a box (approx. 70 kgs) of gaspereau was purchased from individual fishermen for sampling.

A two-stage sampling approach was conducted for all gaspereau samples. In the first stage, approximately 250 gaspereau were identified to species (Northwest Miramichi only in 2011) and measured for fork length. A subsample of gaspereau stratified by 5mm length intervals was retained and often frozen for the second stage of detail sampling at a later time. Up to three or five fish of each species for each 5 mm fork length group less than or greater than 280 mm respectively were kept for detail sampling. Detail sampling consisted of identifying each fish to species, measuring fork length (nearest 1 mm), total weight (nearest 0.1 g), determining the sex, weight of the female's gonad, maturity state of the gonad, and removing scales for age determination. Fork lengths measured from thawed samples were adjusted using the following equation: adjusted length (mm) = 1.0143 x frozen length (mm) + 4.557 (Chaput and LeBlanc 1989).

RESULTS

Gaspereau landed at the Loggieville wharf were sampled on six occasions between May 30 and June 16 and at the Chatham wharf on five occasions between June 7 and June 20. Six gaspereau samples were obtained from fishermen in the Northwest Miramichi between June 7 and June 24. On average, over 250 fish (range 217-311) were measured during the first stage sampling on each occasion (Table 34). The first stage sampling at the Loggieville and Chatham wharves did not identify the fish to species, so the results from the analysis of the second stage sampling were not considered to be representative.

The gaspereau run to the Northwest Miramichi was comprised almost exclusively of alewives during the early part of the season but dropped consistently to 41% of the run by June 20 (Fig. 39). The proportion alewife increased to 64% in the last sample on June 24, and likely represented spent fish descending the estuary. Alewives kept for detail sampling (N = 177) were 49% male and 51% female. The majority of the fish were age 3 (57%), followed by those age 4 (37%), and those age 5 (6%). The majority (97%) of

alewives were maiden fish while only 3% (five fish) had spawned previously. All alewives had a mean fork length of 245 mm but females were generally longer than males (except at age 5) (Table 35, Fig. 40). The mean fork length of alewives in samples decreased progressively from 244 mm on June 7 to 236 mm on June 24 (Fig. 41).

Blueback herring were negligible in gaspereau catches before June 10 but increased consistently until June 20 when they represented the bulk (59%) of the run (Fig. 39). Similar to the sex ratio for alewives, samples of blueback herring (n=94) were 52% female and 48% male. Blueback herring had a broader age distribution than alewives with the majority (65%) age 5, followed by those age 4 (14%), age 6 (12%), age 3 (8%), and age 7 (1%) (Table 35). In contrast to the alewives, the majority (60%) of blueback herring were repeat spawners, while 40% were maiden fish. Blueback herring were on average longer than alewives with a mean fork length of all samples at 251 mm. Female blueback herring were consistently longer than males of the same age (Table 35, Fig. 40). The mean fork length of blueback herring in samples decreased progressively from 257 mm on June 7 to 241 mm on June 24 (Fig. 41).

STRIPED BASS MONITORING PROGRAM

The commercial gaspereau fishery of the Miramichi River has provided the platform from which the striped bass population of the southern Gulf of St. Lawrence has been assessed since 1993. The Northwest Miramichi estuary remains the only confirmed spawning location for the southern Gulf of St. Lawrence striped bass population (Robichaud-LeBlanc et al. 1996). The population abundance has generally been estimated from a mark and recapture experiment where adult striped bass were tagged early in May and followed throughout June as they were captured and released as bycatch in the gaspereau fishery of the Northwest Miramichi estuary. Analyses of catch per unit of effort from this fishery has also been an index of abundance for southern Gulf striped bass since 1993 (Douglas and Chaput 2011).

METHODS

A mark and recapture experiment to assess the run size of striped bass in the Miramichi River was not performed during the spring of 2011. The bycatch sampling of the Northwest Miramichi gaspereau fishery continued as usual with several trapnets sampled on most days that the fishery occurred. All striped bass were identified to life stage (adult or juvenile) and counted before being released. The collection of biological characteristics was not possible given the high abundance of striped bass and the inability of the crew to process fish fast enough before significant mortality occurred.

RESULTS

The gaspereau season for individuals fishing in the Northwest Miramichi estuary occurred between May 30 and June 27 in 2011. A total of 2 to 12 trapnets were fished daily on 19 days throughout the season while 2 to 7 trapnets were sampled daily for bycatch on 15 days throughout the season (Fig. 42). This sampling effort resulted in 67 trapnet samples of a possible 168 (40%) in 2011.

Due to the large abundance of striped bass, some sampling events early in the season required an estimation or partial estimation of the total catch between June 1 and June

4. During this time, some fishermen emptied their total catch back into the river without manipulation, others used the regular method of dipping the catch out but emptied it directly back to the river instead of in their boat. This later method permitted a reasonable approach to estimating the total striped bass bycatch by counting the number of striped bass in a single dipnet and scaling it to the total number of discarded dipnets. No effort was made to estimate catches that were released without manipulation.

Similar to previous years, catches of striped bass in the gaspereau fishery of the Northwest Miramichi estuary were highest early in the season and had diminished significantly by mid June (Fig. 43). The peak catches occurred on June 1 when standardized catches of striped bass (bass per net per day) exceeded 2,600 fish in two individual trapnets. These striped bass catches were the highest on record since the bycatch monitoring of this fishery began in 1993. The combined catch on June 1 from four trapnets with varying soak times between 0.5 and 2.5 days was conservatively estimated at about 11,000 adult striped bass.

POINTS OF INTEREST FOR 2011

NEW MANAGEMENT MEASURES

The low salmon escapement levels to the Northwest Miramichi River over the last several years prompted DFO Fisheries Management and the Miramichi Watershed Management Committee to implement new management measures in 2011 that will remain in effect for three years (2011, 2012 and 2013), unless there is a major change in the level of conservation attainment. The Gulf Region Close Time and Quota Variation Order 2011-058 came into force on June 30, 2011 and read:

Effective July 6, 2011, at 12:00 p.m. (noon), the following stretches became mandatory catch and release: the portion of the Little Southwest Miramichi and its tributaries upstream from Catamaran Brook, the portion of the Northwest Miramichi upstream from Little River, both the north and south branches of the Sevogle River upstream from and including Square Forks. In 2012 and beyond, these catch and release restrictions will be in effect for the entire season.

Also effective July 6, 2011, at 12:00 p.m. (noon) until July 31, 2011, the portion of the Northwest Miramichi from and including Little River downstream to Wayerton Bridge at Route 430 will become mandatory catch and release. In 2012 and beyond, this catch and release restriction will be in effect from June 1 to July 31.

RESEARCH COLLABORATIONS

At the request of Dr. Okechukwu Igboeli from the Atlantic Veterinary College in Prince Edward Island, several samples of sea lice were collected from returning adult salmon captured in DFO's index trapnets on both the Southwest and Northwest Miramichi rivers in 2011. Dr. Igboeli's research is focusing on the development of drug resistance to emamectin benzoate (SLICE), a formerly highly effective sea lice medicine.

At the request of Dr. Lena Measures, DFO scientist at the Maurice Lamontagne Institute in Quebec, juvenile (age 1) striped bass (n = 35) were collected from DFO's index

trapnets on both the Southwest and Northwest Miramichi rivers in 2011. Dr. Measures' research focuses on the timing of parasite infection in young fish and their subsequent growth as the fish gets older. Dr. Measures was also supplied with approximately 60 young-of-the-year striped bass to assess levels of parasites during their first growing season. The otoliths from these same striped bass were provided to M. Michel Legault, biologist with the Ministère des Ressources naturelles in Quebec. His intentions were to obtain the chemical fingerprint specific to the otoliths of southern Gulf striped bass so that the origin (southern Gulf of St. Lawrence population or St. Lawrence estuary population) of samples collected along the coasts of Quebec could be identified.

ENVIRONMENTAL CONDITIONS

Close to average precipitation was recorded in New Brunswick for 2011. The highest precipitation for the Miramichi area was recorded in the month of August. Monthly air temperatures were slightly higher than normal particularly in January and from September to December (Caissie 2012). Below normal air temperatures were recorded for the months of May and June (Caissie 2012).

Data collected from the Environment Canada's hydrological stations at Blackville on the Southwest Miramichi River, Littleton on the Little Southwest Miramichi River and at Trout Brook on the Northwest Miramichi River in 2011 showed higher than normal flows for the months of March through to September with excessive flows recorded for June, August and September (Fig. 44) (Caissie 2012).

ANGLER REPORTS

Anglers reported that Atlantic salmon angling in 2011 was excellent with good catches of both small and large salmon. In some cases, outfitting camps broke 40 year old records for the numbers of salmon and grilse angled. Similarly, angling on the crown reserve stretches of the Northwest Miramichi was excellent and the numbers of salmon and grilse caught were at levels not seen since the 1970s. Anglers attributed the good fishing to good numbers of fish and frequent rain that kept water temperatures cool and water levels at a good height for angling. Anglers perceived the summer run to be stronger than the fall run.

ACRONYMS AND DEFINITIONS

1SW salmon (grilse)	One-sea-winter salmon, also called grilse. Maiden salmon which have spent one winter at sea.
2SW salmon	Two-sea-winter salmon. Maiden salmon which have spent two winters at sea.
3SW salmon	Three-sea-winter salmon. Maiden salmon which have spent three winters at sea.
Kelt	A salmon that has spawned but not yet migrated to sea.
Large salmon	Salmon of fork length greater than or equal to 63 cm.
LSW	Little Southwest Miramichi River (see Figure 1).

Maiden salmon	Salmon returning to fresh water to spawn for the first time
MSW	Multi-sea-winter salmon including maiden and repeat spawners of a total sea age greater than one year (this excludes 1SW salmon).
NW	Northwest Miramichi River (see Figure 1).
Repeat spawner	Salmon on a second or greater spawning migration
RST	Rotary screw trap.
SM	Spawning mark.
Small salmon	Salmon of fork length less than 63 cm.
Smolt	Juvenile salmon that have undergone physiological transformation in preparation for migration at sea
SW	Southwest Miramichi River (see Figure 1).

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The diadromous fish monitoring programs in the Miramichi system are complex and require significant contributions from many individuals and organizations. The individuals listed below all made important contributions to monitoring programs in the Miramichi system in 2011 and all have the same objective of working together to better manage natural resources.

We are indebted to Debbie and Dale Norton of the NSPA for their continued interest and dedication to the smolt program on the Little Southwest Miramichi. The NSPA made the substantial contribution of hiring five summer students in 2011 that were solely devoted to DFO's diadromous programs in the Miramichi system. Summer students (in alphabetical order) Courtney Flannagan, Ian Hambrook, Kimberly Hayward, Kenneth Nowlan, and Jacob Tozer were invaluable to all field and laboratory operations. The adult salmon mark and recapture experiment would not be possible without the contributions of Eel Ground and Metepenagiag First Nations. We thank Eel Ground First Nation Chief, George Ginnish, fisheries councillor Emerson Francis, and trap crew leaders Joe Simonson and Chris Ward and their crews for providing data from their trapnet catches and applying Carlin tags to salmon and grilse before releasing them to the wild. Similarly we thank Metepenagiag First Nation Chief, Freeman Ward, fisheries' councillor Norman Ward and crew supervisors William Ward and Brian Tenass and their crews for providing data on their trapnet catches and checking for recaptured grilse and salmon carrying Carlin tags. We are grateful to Mark Hambrook and the MSA for hiring Alan Francis, Matthew Ward, and Jan Mitchell who were devoted to DFO's electrofishing survey. In addition, we would like to thank MSA employee, Tyler Story, who was a crew leader on the smolt wheel operations and was available for the electrofishing survey as required. Similarly, MSA contract employees Carl Carter, Peter McKibbon, and Alex Riebel were invaluable during the autumn trapnet operations. We are thankful to Nola Chaisson of the MSA who facilitated all staff/student contracts and negotiations between the associations and DFO. We thank DFO staff Dorice Daigle and Jeffrey McFadden for assistance with the sampling of the commercial catch and bycatch of gaspereau. We are grateful to DFO staff Noella McDonald who aged all fish scales collected from all Miramichi monitoring programs in 2011. The commercial gaspereau fishermen of the

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Table 1. Rotary screw trap and trapnet locations with start and end dates for 2011. The dates identified for the operation of trapnets by Eel Ground First Nation indicate the time when they switched from fishing gaspereau commercially to fishing for the purpose of food (small salmon) and science (large salmon tagging) as part of their 2011 Aboriginal Fisheries Strategy agreement.

System	Gear	Location	Latitude	Longitude	Operation dates Start	Operation dates End	Fishing events
SW Miramichi							
	Trapnet	DFO Millerton	46.877750	-65.663833	30-May-11	21-Oct-11	136
	Trapnet	Eel Ground Enclosure (lower)	46.959494	-65.586448	1-Jul-11	23-Aug-11	24
	Trapnet	Eel Ground Above RR bridge (upper)	46.954696	-65.593333	3-Jul-11	15-Sep-11	44
NW Miramichi							
	RST	LSW Oxbow	46.955170	-65.860460	3-May-11	5-Jun-11	27
	RST	NW at Trout Brook	47.095688	-65.837426	2-May-11	4-Jun-11	28
	RST	Big Sevogle	47.046246	-65.837879	2-May-11	4-Jun-11	26
	Trapnet	DFO Cassilis (smolt)	46.934667	-65.784068	17-May-11	10-Jun-11	24
	Trapnet	DFO Cassilis (adult)	46.934667	-65.784068	13-Jun-11	21-Oct-11	111
	Trapnet	Red Bank LSW	46.943417	-65.822899	28-Jun-11	30-Sep-11	48
	Trapnet	Red Bank NW	46.948107	-65.821057	27-Jul-11	23-Aug-11	5

Table 2. Total catch of all species in the RST operated at the Oxbow site on the Little Southwest Miramichi River in 2011. (Sea lamprey caught on May 15 & 16 were recorded as ammocoetes)

	SPECIES												
Date	sea lamprey	Atlantic salmon parr	Atlantic salmon smolt	Atlantic salmon kelt (small)	brook trout	rainbow smelt	lake chub	blacknose dace	common shiner	white sucker	American eel	yellow perch	Total
4-May-11	3		3										6
10-May-11			2			1,800							1,802
11-May-11			8	1		2,000							2,009
12-May-11			9	1		3,500				1			3,511
13-May-11			13	1		8,000					1		8,016
14-May-11		1	4			18,000					2		18,007
15-May-11	*2*	1	1	3		10,000	2				2		10,011
16-May-11	*1*		9			10,000					1		10,011
17-May-11			6			15,000				2			15,008
18-May-11			19			2,000							2,019
19-May-11			21	2		4,005				1			4,029
21-May-11			130	1		8,000							8,131
22-May-11		1	226	1		7,000	2				2		7,232
23-May-11	7	3	157			2,200					3	1	2,371
24-May-11	7	15	119			100		3			4		248
25-May-11		5	114		1				5	3	1		129
26-May-11	10	7	285						75		5		382
27-May-11	9	6	157						75	2	2		251
28-May-11		3	50						5	5	1		64
29-May-11	5	5	141						30	6			187
30-May-11	10	10	250								2		272
31-May-11	10	6	123						5	1	6		152
1-Jun-11	1	6	37						40	2	3		89
2-Jun-11	1	2	30						10		10		53
3-Jun-11	1	6	10						40	1	6		64
4-Jun-11		5	2						30	4	4		45
5-Jun-11	3	4	2						20		3		32
Total	70	86	1,928	10	1	91,605	4	3	335	28	58	1	94,129

Table 3. Status of Atlantic salmon smolts captured at the RST on the Little Southwest Miramichi River in 2011.

Date	Incidental mortality	Released					Total first time catch	Grand total
		Injured	Unsampled	Sampled	Tagged	Oxbow recaps		
4-May-11			3				3	3
10-May-11					2		2	2
11-May-11					8		8	8
12-May-11				1	8		9	9
13-May-11	5			1	7		13	13
14-May-11					4		4	4
15-May-11			1				1	1
16-May-11	2			1	6		9	9
17-May-11				1	5		6	6
18-May-11				3	16		19	19
19-May-11	3		2	3	13		21	21
21-May-11	9		38	5	78		130	130
22-May-11	15		107	5	98	1	225	226
23-May-11	7		46		100	4	153	157
24-May-11	3		14		99	3	116	119
25-May-11			9	5	98	2	112	114
26-May-11			173	5	100	7	278	285
27-May-11			50	5	100	2	155	157
28-May-11			1		47	2	48	50
29-May-11	12		17	5	102	5	136	141
30-May-11	11		184	5	49	1	249	250
31-May-11	73		3	5	42		123	123
1-Jun-11	3		2	5	27		37	37
2-Jun-11	6		2	4	17	1	29	30
3-Jun-11				2	8		10	10
4-Jun-11					2		2	2
5-Jun-11			1			1	1	2
Total	149	-	653	61	1,036	29	1,899	1,928

Table 4. Estimates of Atlantic salmon smolts emigrating from the Little Southwest Miramichi, Northwest Miramichi, and Big Sevogle rivers in 2011 and the Northwest Miramichi system as a whole.

Year	Catch at lower RST	Tagging location	Number of		Run size estimate			Smolts per 100 m^2		
			Tags placed	Recaptures	Median	Lower CI (2.5)	Upper CI (97.5)	Mode	Lower	Upper
2005	1,100	LSW - upper	549	7	81,290	44,290	175,900	0.9	0.5	2.0
2005	1,100	LSW - recycled	880	22	36,840	25,380	56,490	0.4	0.3	0.6
2005	1,100	Combined	1,429	29	46,330	32,710	68,050	0.5	0.4	0.8
2006	1,387	LSW - upper	487	6	89,470	56,360	209,800	1.0	0.6	2.4
2006	1,387	LSW - recycled	892	18	77,380	48,640	122,900	0.9	0.6	1.4
2006	1,387	Combined	1,379	24	**87,520**	41,760	665,300	**1.0**	0.5	7.6
2007	1,946	LSW - upper	2,557	29	154,800	110,300	226,100	1.8	1.3	2.6
2007	1,946	LSW - recycled	1,434	22	115,600	7,900	182,600	1.3	0.9	2.1
2007	1,946	Combined	3,991	51	**138,200**	106,000	158,500	**1.6**	1.2	2.1
2008	2,702	LSW - upper	1,159	18	166,900	106,800	271,900	1.9	1.2	3.1
2008	2,702	LSW - recycled	1,508	35	102,900	76,100	146,500	1.2	0.9	1.7
2008	2,702	Combined	2,667	53	**124,100**	96,320	164,900	**1.4**	1.1	1.9
2009	3,478	Oxbow - recycled	1,369	63	85,000	66,000	112,000	**1.0**	0.8	1.3
2010	981	Oxbow - recycled	724	15	46,500	28,500	82,500	**0.5**	0.3	0.9
2011	1,899	Oxbow - recycled	1,036	29	67,900	49,900	104,500	0.9	0.6	1.3
2011	1,170	Northwest - recycled	1,061	28	44,200	32,400	68,600	1.2	0.9	1.8
2011	901	Big Sevogle - recycled	817	13	56,800	37,200	114,000	2.0	1.3	3.9
2011	*9,930	NW combined	2,914	33	**768,000**	576,000	1,137,000	**4.6**	3.4	6.8

* smolt catch at Cassilis trapnet

Table 5. The number of recaptured smolts (percentage in parentheses) according to the number of days between their release and recapture date.

Location		Days to recapture											
Tagged	**Recaptured**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
LSW RST	**LSW RST**	16 (55)	9 (31)	3 (10)		1 (3)							
NW RST	**NW RST**	26 (93)	1 (4)		1 (4)								
Big Sevogle RST	**Big Sevogle RST**	11 (85)			1 (8)			1 (8)					
LSW RST	**Cassilis trapnet**	4 (31)	2 (15)	6 (46)		1 (8)							
NW RST	**Cassilis trapnet**			3 (27)	2 (18)		1 (9)			1 (9)	1 (9)	2 (18)	1 (9)
Big Sevogle RST	**Cassilis trapnet**	2 (22)	1 (11)	2 (22)		1 (11)	1 (11)		1 (11)		1 (11)		
All RSTs	**Cassilis trapnet**	6 (18)	3 (9)	11 (33)	2 (6)	2 (6)	2 (6)		1 (3)	1 (3)	2 (6)	2 (6)	1 (3)

Table 6. Biological characteristics of Atlantic salmon smolts sampled in the Northwest Miramichi system in 2011. RS = released sampled, RT = released tagged, M = mortality, and MZ = mortality research sample.

	LSW Oxbow		NW Trout Brook		Big Sevogle		Cassilis	
	RS+RT	M	RS+RT	M	RS+RT	M	RS	MZ
Mean FL	132	128	120	.	121	.	135	120
Range	108 - 168	100 - 155	100 - 168	.	100 - 176	.	105 - 190	93 - 159
N	406	134	489	.	353	.	1,190	247
Mean weight	.	21.9	.		.		.	18.1
Range	.	9.8 - 35.9	.		.		.	6.5 - 37.1
N	.	133	.		.		.	246
Proportion age 2	0.50	0.40	0.59	.	0.31	.	.	0.61
N	25	42	50	.	19	.	.	146
Proportion age 3	0.50	0.59	0.4	.	0.63	.	.	0.38
N	25	61	34	.	39	.	.	91
Proportion age 4	0.00	0.01	0.01	.	0.06	.	.	0.00
N	0	1	1	.	4	.	.	1
Percent female	.	0.47	.	.	.	.	.	0.42
N	.	62	.	.	.	.	.	97
Percent male	.	0.53	.	.	.	.	.	0.58
N	.	71	.	.	.	.	.	132
Percent wild	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
N	1,779	149	1,193	5	912	2	9,652	296
Percent hatchery	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	0	0	2	0	1	0	11	0

Table 7. Total catch of all species in the RST operated in the Northwest Miramichi River in 2011. Stickleback sp. includes non-specific sticklebacks, 3-spine sticklebacks and 9-spine sticklebacks.

	SPECIES												
Date	sea lamprey	Atlantic salmon parr	Atlantic salmon smolt	Atlantic salmon kelt (small)	brook trout	lake chub	blacknose dace	common shiner	white sucker	Brown bullhead	American eel	Stickleback sp.	Total
3-May-11		5		1									6
4-May-11		17	16										33
9-May-11		17	41		4								62
10-May-11	3	15	59		1		1	1					80
12-May-11	1	46	53		2						3		105
13-May-11	4	47	80		5	2	4						142
14-May-11	15	47	20		4		2						88
15-May-11	35	53	17				8					1	114
16-May-11	14	59	32				9					1	115
17-May-11	25	30	8			1						1	65
18-May-11	11	17	14				2					3	47
19-May-11	9	25	16		2	1	14						67
20-May-11	5	15	24		16	2	6						68
21-May-11	8	34	128		13	1	9		1				194
22-May-11	4	45	307		17	1	1					1	376
23-May-11	8	15	60				2		2				87
24-May-11	2	22	36				3		1				64
25-May-11		11	25				4						40
26-May-11	2	8	25		3	1	7		1				47
27-May-11	1	7	18		1		5						32
28-May-11	1	7	12		3	2	1						26
29-May-11	3	23	72				1						99
30-May-11		13	108				4				1		126
31-May-11	1	7	17				5			1	1	1	33
1-Jun-11	2	4	10		2		20					2	40
2-Jun-11		1					1						2
3-Jun-11							6					2	8
4-Jun-11		2			4		6		2				14
Total	154	592	1,198	1	77	11	121	1	7	1	5	12	2,180

Table 8. The status of Atlantic salmon smolts captured at the RST on the Northwest Miramichi River in 2011.

Date	Incidental mortality	Released					Total first time catch	Grand total
		Injured	Unsampled	Sampled	Tagged	NW RST recaps		
4-May-11		1		3	12		16	16
5-May-11							0	0
6-May-11							0	0
7-May-11							0	0
8-May-11							0	0
9-May-11				5	36		41	41
10-May-11	2			5	52		59	59
11-May-11							0	0
12-May-11				5	48		53	53
13-May-11				5	74	1	79	80
14-May-11	1			3	15	1	19	20
15-May-11				3	13	1	16	17
16-May-11		1		5	26		32	32
17-May-11				1	7		8	8
18-May-11				2	12		14	14
19-May-11				3	13		16	16
20-May-11				4	19	1	23	24
21-May-11				5	123		128	128
22-May-11				5	295	7	300	307
23-May-11		1		6	44	9	51	60
24-May-11	1			6	29		36	36
25-May-11		1		4	18	2	23	25
26-May-11		1		4	20		25	25
27-May-11		1		3	14		18	18
28-May-11				2	10		12	12
29-May-11				5	65	2	70	72
30-May-11	1	3		5	95	4	104	108
31-May-11				4	13		17	17
1-Jun-11				2	8		10	10
2-Jun-11							0	0
3-Jun-11							0	0
4-Jun-11							0	0
Total	5	9	0	95	1,061	28	1,170	1,198

Table 9. Total catch of all species in the RST operated in the Big Sevogle River in 2011.

	SPECIES									
Date	sea lamprey	Atlantic salmon parr	Atlantic salmon smolt	rainbow smelt	lake chub	blacknose dace	creek chub	common shiner	white sucker	Total
3-May-11		3	15							18
4-May-11		7	7							14
5-May-11			2							2
6-May-11			10							10
7-May-11			3							3
8-May-11									1	1
9-May-11	1	2	5							8
10-May-11		1	8		1					10
11-May-11		1	4							5
12-May-11		2	14		1			1	1	19
13-May-11		2	38	100	13	4				157
14-May-11		10	182	121	23	3		1		340
15-May-11		10	118	3	19	6			2	158
16-May-11		6	43		13				1	63
17-May-11		7	46		4				1	58
18-May-11	1	6	30		2				2	41
19-May-11		7	39		16					62
20-May-11		3	50		20				2	75
21-May-11		6	49		3	1		1	1	61
22-May-11		2	65		3				5	75
23-May-11		16	157		1					174
24-May-11		1	19				2			22
25-May-11			8		10				3	21
26-May-11		2	2		20			1		25
27-May-11					14				2	16
28-May-11					12				1	13
Total	2	94	914	224	175	14	2	4	22	1,451

Table 10. Status of all Atlantic salmon smolts captured at the RST on the Big Sevogle River in 2011.

Date	Incidental mortality	Released					Total first time catch	Grand total
		Injured	Unsampled	Sampled	Tagged	Sev. RST recaps		
3-May-11			15				15	15
4-May-11				1	6		7	7
5-May-11							0	0
6-May-11							0	0
7-May-11							0	0
8-May-11							0	0
9-May-11							0	0
10-May-11							0	0
11-May-11							0	0
12-May-11					2		2	2
13-May-11				2	8		10	10
14-May-11					2	1	2	3
15-May-11							0	0
16-May-11				1	4		5	5
17-May-11				1	7		8	8
18-May-11					4		4	4
19-May-11				2	12		14	14
20-May-11				5	33		38	38
21-May-11				5	176	1	181	182
22-May-11	1			5	110	2	116	118
23-May-11				5	38		43	43
24-May-11	1			5	40		46	46
25-May-11				5	25		30	30
26-May-11				5	33	1	38	39
27-May-11				5	43	2	48	50
28-May-11				5	44		49	49
29-May-11				6	58	1	64	65
30-May-11				5	151	1	156	157
31-May-11				3	12	4	15	19
1-Jun-11				1	7		8	8
2-Jun-11					2		2	2
3-Jun-11								
4-Jun-11							0	0
Total	2	0	15	67	817	13	901	914

Table 11. Total catch of all species at the Cassilis trapnet during the 2011 smolt run.

	SPECIES														
Date	gaspereau	American shad	Atlantic salmon parr	Atlantic salmon smolt	Atlantic salmon kelt (small)	Atlantic salmon kelt (large)	brook trout	rainbow smelt	creek chub	fallfish	common shiner	American eel	3 spine stickleback	striped bass	Total
18-May-11				4		1	2	4,126					1		4,134
19-May-11			3	11	5	17	1	2,300					1		2,338
20-May-11				70	7	5	2	7,588							7,672
21-May-11	1		2	3,680	10	3	2	11,206			2				14,906
22-May-11			1	296	1			8,840			3				9,141
23-May-11	1		3	200		1	1	4,004							4,210
24-May-11	7			238	3	2	3	3,889							4,142
25-May-11	10			408	2		3	61					1		485
26-May-11	8			1,685	9	2	2								1,706
27-May-11	21		4	1,996	5	3		1			1			6	2,037
28-May-11	2			733								1		674	1,410
29-May-11	1			47	1			25				2			76
30-May-11	4		2	70											76
31-May-11	4			47								5	1		57
1-Jun-11		3		74										166	243
2-Jun-11	5	1		40			2	2						9	59
3-Jun-11	17		1	79											97
4-Jun-11	1	1		22								2			26
5-Jun-11	1			79					2	2					84
6-Jun-11	6			60											66
7-Jun-11	36	1		27										1	65
8-Jun-11	57			43		1								5	106
9-Jun-11	34		2	39								1			76
10-Jun-11	65	2	1	16											84
Total	281	8	19	9,964	43	35	18	42,042	2	2	6	11	4	861	53,296

Table 12. Status of all Atlantic salmon smolts captured at the Cassilis trapnet located in the Northwest Miramichi estuary in 2011.

	Removals		Released					Total first	Grand
Date	Mortality	Experimental	Injured	Unsampled	Sampled	RST recaps	RST recap (lost)	time catch	total
18-May-11					4			4	4
19-May-11		2			9			11	11
20-May-11		15			55			70	70
21-May-11		20		3572	80	8		3,672	3,680
22-May-11		20		196	80			296	296
23-May-11		20		98	81	1		199	200
24-May-11		20		136	82			238	238
25-May-11		20		305	80	3		405	408
26-May-11		21		1574	82	8		1,677	1,685
27-May-11		20		1888	82	6		1,990	1,996
28-May-11	5	21		627	80			733	733
29-May-11		9			38			47	47
30-May-11		14		1	55			70	70
31-May-11		9			38			47	47
1-Jun-11		14			58	2		72	74
2-Jun-11				40				40	40
3-Jun-11		15			63	1		78	79
4-Jun-11		5			17			22	22
5-Jun-11		15			62	1	1	77	79
6-Jun-11		12			48			60	60
7-Jun-11		5			21	1		26	27
8-Jun-11		8			34	1		42	43
9-Jun-11	2	7			29	1		38	39
10-Jun-11		2		1	13			16	16
Total	7	294	0	8,438	1,191	33	1	9,930	9,964

Table 13. Total catch of all species by week at the Cassilis trapnet located in the Northwest Miramichi estuary in 2011. Large catches of gaspereau in June and July were estimated. Gaspereau is a collective term for alewife and blueback herring when they are not identified to species.

	SPECIES														
Date	sea lamprey	gaspereau	alewife	American shad	blueback herring	Atlantic salmon (small)	Atlantic salmon (large)	Atlantic salmon (large kelt)	brook trout	fallfish	white sucker	American eel	white perch	striped bass	Total
Jun. 14 - Jun. 20	1	1,475	106	131	129	39	3	0	1	0	2	0	0	12	1,899
Jun. 21 - Jun. 27	0	1,297	25	61	55	194	28	0	0	1	0	2	1	5	1,669
Jun. 28 - Jul. 4	0	2,295	51	20	200	249	38	0	0	0	1	3	0	2	2,859
Jul. 5 - Jul. 11	0	2,200	0	9	0	364	137	0	0	0	0	2	0	5	2,717
Jul. 12 - Jul. 18	0	2,880	0	5	0	136	98	0	0	0	3	5	0	28	3,155
Jul. 19 - Jul. 25	0	103	0	1	0	16	13	0	0	0	0	1	0	17	151
Jul. 26 - Aug. 1	0	35	0	1	0	35	35	0	0	0	0	0	0	10	116
Aug. 2 - Aug. 8	0	5	0	0	0	16	16	0	0	0	0	0	0	1	38
Aug. 9 - Aug. 15	0	0	0	0	0	3	4	0	0	0	1	0	0	2	10
Aug. 16 - Aug. 22	0	0	0	0	0	9	12	0	0	0	0	1	0	5	27
Aug. 23 - Aug. 29	0	2	0	0	0	5	2	0	0	0	2	0	0	3	14
Aug. 30 - Sep. 5	0	1	0	0	0	8	5	0	0	0	0	0	0	0	14
Sep. 6 - Sep. 12	0	12	0	0	0	19	13	0	0	0	1	0	0	0	45
Sep. 13 - Sep. 19	0	1	0	0	0	10	5	0	0	3	0	0	0	2	21
Sep. 20 - Sep. 26	0	0	0	0	0	13	9	0	1	2	1	0	0	0	26
Sep. 27 - Oct. 3	0	0	0	0	0	10	5	0	0	1	0	0	0	0	16
Oct. 4 - Oct. 10	0	0	0	0	0	66	44	0	1	0	2	0	0	4	117
Oct. 11 - Oct. 17	0	0	0	0	0	19	18	2	1	0	0	0	1	9	167
Oct. 18 - Oct. 21	0	0	0	0	0	2	5	0	0	0	1	0	0	27	35
Total	1	10,306	182	228	384	1,213	490	2	4	7	14	14	2	132	12,979

Table 14. Biological characteristics of small salmon sampled from the Cassilis trapnet in the Northwest Miramichi River in 2011. Spawning categories are as follows: 1SW, 2SW and 3SW are maiden first time spawners. "C" refers to consecutive second time spawners and "C +" are repeat spawners on a third or more migration which returned the second time as a consecutive. "A" are alternate second time spawners and "A +" are repeat spawners on a third or more migration which returned the second time as an alternate spawner (Chaput et al. 2010). SM = spawning mark.

			Age		Age at previous spawning						Spawning		Fork length (mm)		
Location	Size	Sex	River	Sea	SM1	SM2	SM3	SM4	SM5	SM6	category	Qty	Min	Max	Mean
Cassilis	Small	M	2	1							1SW maiden	146	514	629	571
Cassilis	Small	M	3	1							1SW maiden	102	529	629	576
Cassilis	Small	M	4	1							1SW maiden	1	590	590	590
Cassilis	Small	M	.	1							1SW maiden	24	541	629	579
Cassilis	Small	M	2	2	1						1SW C	1	572	572	572
Cassilis	Small	M	.	2	1						1SW C	1	618	618	618
Cassilis	Small	F	2	1							1SW maiden	18	510	602	560
Cassilis	Small	F	3	1							1SW maiden	16	531	618	571
Cassilis	Small	F	.	1							1SW maiden	2	541	590	566
Cassilis	Small	U	2	1							1SW maiden	190	484	604	551
Cassilis	Small	U	3	1							1SW maiden	288	499	626	559
Cassilis	Small	U	4	1							1SW maiden	2	515	586	551
Cassilis	Small	U	.	1							1SW maiden	47	516	616	556
Cassilis	Small	All	2	1							1SW maiden	354	484	629	560
Cassilis	Small	All	3	1							1SW maiden	406	499	629	563
Cassilis	Small	All	4	1							1SW maiden	3	515	590	564
Cassilis	Small	All	.	1							1SW maiden	73	516	629	564
Cassilis	**Small**	**All**	**All**	**1**							**1SW maiden**	**836**	**484**	**629**	**562**
Cassilis	Small	All	2	2	1						1SW C	1	572	572	572
Cassilis	Small	All	.	2	1						1SW C	1	618	618	618
Total												**838**			
Proportion 1SW maiden												**1.00**			
Proportion River Age 2												**0.46**			
Proportion River Age 3												**0.53**			
Proportion River Age 4												**0.00**			
Proportion repeat spawners												**0.00**			
Proportion River Age 2												**1.00**			
Proportion River Age 3												**0.00**			
Proportion River Age 4												**0.00**			

Table 15. Biological characteristics of large salmon sampled from the Cassilis trapnet in the Northwest Miramichi River in 2011. Spawning categories and coding as in Table 14 (above).

			Age		Age at previous spawning						Spawning		Fork length (mm)		
Location	Size	Sex	River	Sea	SM1	SM2	SM3	SM4	SM5	SM6	category	Qty	Min	Max	Mean
Cassilis	Large	M	2	1							1SW maiden	2	630	640	635
Cassilis	Large	M	3	1							1SW maiden	5	632	651	640
Cassilis	Large	M	2	2							2SW maiden	8	700	934	790
Cassilis	Large	M	3	2							2SW maiden	6	756	869	814
Cassilis	Large	M	.	2							2SW maiden	1	782	782	782
Cassilis	Large	M	2	2	1						1SW C	3	644	678	665
Cassilis	Large	M	3	2	1						1SW C	2	642	666	654
Cassilis	Large	M	.	2	1						1SW C	1	638	638	638
Cassilis	Large	M	2	3	1	2					1SW C+	2	735	755	745
Cassilis	Large	M	3	3	1	2					1SW C+	1	642	642	642
Cassilis	Large	M	2	3	1						1SW A	2	817	850	834
Cassilis	Large	M	3	3	2						2SW C	1	879	879	879
Cassilis	Large	M	2	4	2						2SW A	1	915	915	915
Cassilis	Large	M	3	4	2						2SW A	1	930	930	930
Cassilis	Large	F	2	2							2SW maiden	159	709	827	774
Cassilis	Large	F	3	2							2SW maiden	139	651	856	781
Cassilis	Large	F	.	2							2SW maiden	32	737	878	779
Cassilis	Large	F	2	2	1						1SW C	1	753	753	753
Cassilis	Large	F	3	2	1						1SW C	1	674	674	674
Cassilis	Large	F	3	3	1	2					1SW C+	1	763	763	763
Cassilis	Large	F	2	3	1						1SW A	1	861	861	861
Cassilis	Large	F	3	3	1						1SW A	1	772	772	772
Cassilis	Large	F	3	4	1	3					1SW A+	1	846	846	846
Cassilis	Large	F	2	3	2						2SW C	4	782	853	827
Cassilis	Large	F	3	3	2						2SW C	2	806	825	816
Cassilis	Large	F	2	4	2	3					2SW C+	2	769	875	822
Cassilis	Large	F	2	5	2	3	4				2SW C+	2	902	917	910
Cassilis	Large	F	2	4	2						2SW A	5	912	973	938
Cassilis	Large	F	3	4	2						2SW A	2	892	908	900
Cassilis	Large	F	.	4	2						2SW A	1	923	923	923
Cassilis	Large	F	2	.							unknown	1	771	771	771
Cassilis	Large	U	2	2							2SW maiden	3	781	795	787
Cassilis	Large	U	3	2							2SW maiden	1	766	766	766
Cassilis	Large	.	3	1							1SW maiden	1	658	658	658
Cassilis	Large	All	2	1							1SW maiden	2	630	640	635
Cassilis	Large	All	3	1							1SW maiden	6	632	658	643
Cassilis	**Large**	**All**	**All**	**1**							**1SW maiden**	**8**	**630**	**658**	**641**
Cassilis	Large	All	2	2							2SW maiden	170	700	834	775
Cassilis	Large	All	3	2							2SW maiden	146	651	869	782
Cassilis	Large	All	.	2							2SW maiden	33	737	878	779
Cassilis	**Large**	**All**	**All**	**2**							**2SW maiden**	**349**	**651**	**878**	**778**
Cassilis	Large	All	2	2	1						1SW C	4	644	753	687
Cassilis	Large	All	3	2	1						1SW C	3	642	674	661
Cassilis	Large	All	.	2	1						1SW C	1	638	638	638
Cassilis	Large	All	2	3	1	2					1SW C+	2	735	755	745
Cassilis	Large	All	3	3	1	2					1SW C+	2	642	763	703
Cassilis	Large	All	2	3	1						1SW A	3	817	861	843
Cassilis	Large	All	3	3	1						1SW A	1	772	772	772
Cassilis	Large	All	3	4	1	3					1SW A+	1	846	846	846
Cassilis	Large	All	2	3	2						2SW C	4	782	853	827
Cassilis	Large	All	3	3	2						2SW C	3	806	879	837
Cassilis	Large	All	2	4	2	3					2SW C+	2	769	875	922
Cassilis	Large	All	2	5	2	3	4				2SW C+	2	902	817	910
Cassilis	Large	All	2	4	2						2SW A	6	912	973	934
Cassilis	Large	All	.	4	2						2SW A	1	923	923	923
Cassilis	Large	All	3	4	2						2SW A	3	892	930	910
Cassilis	Large	All	2	.							unknown	1	771	771	771
Total												**395**			
Proportion											**1SW maiden**	**0.02**			
Proportion											**2SW maiden**	**0.88**			
Proportion River Age 2												**0.54**			
Proportion River Age 3												**0.46**			
Proportion River Age 4												**0.00**			
Proportion											**Repeat spawners**	**0.10**			
Proportion											**1SW C**	**0.02**			
Proportion											**1SW C+**	**0.01**			
Proportion											**1SW A**	**0.01**			
Proportion											**1SW A+**	**0.00**			
Proportion											**2SW C**	**0.02**			
Proportion											**2SW C+**	**0.01**			
Proportion											**2SW A**	**0.03**			
Proportion											**2SW A+**	**0.00**			

Table 16. Total catch of all species by week at the Millerton index trapnet located in the Southwest Miramichi estuary in 2011. Large catches of gaspereau in June and July were estimated. Gaspereau is a collective term for alewife and blueback herring when they are not identified to species.

	Species													
Date	gaspereau	alewife	American shad	blueback herring	Atlantic salmon (small)	Atlantic salmon (large)	brook trout	brook trout (sea run)	fallfish	white sucker	American eel	brown bullhead	striped bass	Total
May 31 - Jun. 6	1,086	167	21	9	8	8	21	1		4	3		685	2,013
Jun. 7 - Jun. 13	3,850	186	63	56	29	8	4	2		64	4		240	4,506
Jun. 14 - Jun. 20	1,580	43	127	134	33	6				21			24	1,968
Jun. 21 - Jun. 27	1,070	40	35	139	78	35			1	9	3		41	1,451
Jun. 28 - Jul. 4	2,115	92	49	165	103	34	2	1		6	1		22	2,590
Jul. 5 - Jul. 11	265		14		833	250	1			2			10	1,375
Jul. 19 - Jul. 25	465		17		211	67							43	803
Jul. 21 - Jul. 27	67		5		212	82	1				1		32	400
Jul. 26 - Aug. 1	20		2		159	55				2	1		22	261
Aug. 2 - Aug. 8	10				53	21					2		12	98
Aug. 9 - Aug. 15	8				14	15				1			1	39
Aug. 15 - Aug. 21	4				11	9						1	17	42
Aug. 22 - Aug. 28					17	7							19	43
Aug. 29 - Sep. 4					15	10				1			3	29
Sep. 5 - Sep. 11	6				30	9			1	4			1	51
Sep. 12 - Sep. 18					46	21					2		10	79
Sep. 19 - Sep. 25					77	34							189	300
Sep. 26 - Oct. 2					34	18	2			1			24	79
Oct. 3 - Oct. 9					91	43							723	857
Oct. 10 - Oct. 16					29	20							1,912	1,961
Oct. 17 - Oct. 21					3	9				1			1,262	1,275
Total	10,546	528	333	503	2,086	761	31	4	2	116	17	1	5,292	20,220

Table 17. Biological characteristics of small salmon sampled from the Millerton trapnet in the Southwest Miramichi River in 2011. Spawning categories and coding as in Table 14 (above).

			Age		Age at previous spawning								Fork length (mm)		
Location	Size	Sex	River	Sea	SM1	SM2	SM3	SM4	SM5	SM6		Qty	Min	Max	Mean
Millerton	Small	M	2	1							1SW maiden	301	506	629	576
Millerton	Small	M	3	1							1SW maiden	247	505	626	576
Millerton	Small	M	4	1							1SW maiden	4	566	591	579
Millerton	Small	M	.	1							1SW maiden	61	501	626	576
Millerton	Small	M	2	2	1						1SW C	2	568	620	594
Millerton	Small	F	2	1							1SW maiden	31	512	598	561
Millerton	Small	F	3	1							1SW maiden	28	521	604	563
Millerton	Small	U	2	1							1SW maiden	183	492	610	551
Millerton	Small	U	3	1							1SW maiden	293	472	615	555
Millerton	Small	U	4	1							1SW maiden	1	607	607	607
Millerton	Small	U	.	1							1SW maiden	38	524	591	555
Millerton	Small	U	2	2	1						1SW C	1	622	622	622
Millerton	Small	.	2	1							1SW maiden	1	586	586	586
Millerton	Small	All	2	1							1SW maiden	516	492	629	566
Millerton	Small	All	3	1							1SW maiden	568	472	626	564
Millerton	Small	All	4	1							1SW maiden	5	566	607	585
Millerton	Small	All	.	1							1SW maiden	99	501	626	568
Millerton	**Small**	**All**	**All**	**1**							**1SW maiden**	**1,188**	**472**	**629**	**565**
Millerton	Small	All	2	2	1						1SW C	3	568	622	603
Total												1,191			
Proportion 1SW maiden												1.00			
Proportion River Age 2												0.47			
Proportion River Age 3												0.52			
Proportion River Age 4												0.00			
Proportion repeat spawners												0.00			
Proportion River Age 2												1.00			
Proportion River Age 3												0.00			
Proportion River Age 4												0.00			

Table 18. Biological characteristics of large salmon sampled from the Millerton trapnet on the Southwest Miramichi in 2011. Spawning categories and coding as in Table 14.

			Age		Age at previous spawning								Fork length (mm)		
Location	Size	Sex	River	Sea	SM1	SM2	SM3	SM4	SM5	SM6		Qty	Min	Max	Mean
Millerton	Large	M	2	1							1SW maiden	9	630	669	642
Millerton	Large	M	3	1							1SW maiden	13	631	684	647
Millerton	Large	M	2	2							2SW maiden	12	745	851	804
Millerton	Large	M	3	2							2SW maiden	11	655	833	782
Millerton	Large	M	.	2							2SW maiden	10	672	828	779
Millerton	Large	M	2	2	1						1SW C	6	636	692	667
Millerton	Large	M	3	2	1						1SW C	3	657	668	664
Millerton	Large	M	.	2	1						1SW C	1	631	631	631
Millerton	Large	M	2	3	1	2					1SW C+	4	669	740	708
Millerton	Large	M	3	3	1	2					1SW C+	5	715	749	727
Millerton	Large	M	2	3	1						1SW A	4	808	893	856
Millerton	Large	M	2	3	2						2SW C	2	822	850	836
Millerton	Large	M	2	4	2	3					2SW C+	4	845	869	859
Millerton	Large	M	2	5	2	3	4				2SW C+	1	880	880	880
Millerton	Large	M	.	5	2	3	4				2SW C+	2	858	914	886
Millerton	Large	M	2	4	2						2SW A	1	977	977	977
Millerton	Large	F	2	2							2SW maiden	228	717	860	780
Millerton	Large	F	3	2							2SW maiden	232	710	875	783
Millerton	Large	F	.	2							2SW maiden	43	755	839	787
Millerton	Large	F	2	3							3SW maiden	1	924	924	924
Millerton	Large	F	2	7	1	2	3	4	5	6	1SW C+	1	934	934	934
Millerton	Large	F	.	3	1	2					1SW C+	1	774	774	774
Millerton	Large	F	2	3	1						1SW A	1	858	858	858
Millerton	Large	F	3	3	1						1SW A	1	777	777	777
Millerton	Large	F	2	4	1	3					1SW A+	1	855	855	855
Millerton	Large	F	2	3	2						2SW C	4	796	846	822
Millerton	Large	F	3	3	2						2SW C	1	813	813	813
Millerton	Large	F	3	4	2	3					2SW C	5	847	891	867
Millerton	Large	F	.	3	2						2SW C	2	833	853	843
Millerton	Large	F	2	4	2	3					2SW C+	13	811	877	838
Millerton	Large	F	2	6	2	3	4	5			2SW C+	1	944	944	944
Millerton	Large	F	.	4	2	3					2SW C+	2	822	871	847
Millerton	Large	F	.	5	2	3					2SW C+	1	950	950	950
Millerton	Large	F	2	4	2						2SW A	9	871	970	910
Millerton	Large	F	3	4	2						2SW A	5	882	934	902
Millerton	Large	F	.	4	2						2SW A	3	917	976	956
Millerton	Large	F	2	5	2	4					2SW A+	3	930	970	951
Millerton	Large	F	.	5	2	4					2SW A+	1	961	961	961
Millerton	Large	U	2	2							2SW maiden	1	748	748	748
Millerton	Large	U	.	2							2SW maiden	1	792	792	792
Millerton	Large	All	2	1							1SW maiden	9	630	669	642
Millerton	Large	All	3	1							1SW maiden	13	631	684	646
Millerton	**Large**	**All**	**All**								**1SW maiden**	**22**	**630**	**684**	**645**
Millerton	Large	All	2	2							2SW maiden	241	717	860	781
Millerton	Large	All	3	2							2SW maiden	243	655	875	783
Millerton	Large	All	.	2							2SW maiden	54	672	839	785
Millerton	**Large**	**All**	**All**								**2SW maiden**	**538**	**655**	**875**	**782**
Millerton	Large	All	2	3							3SW maiden	1	924	924	924
Millerton	Large	All	2	2	1						1SW C	6	636	692	667
Millerton	Large	All	3	2	1						1SW C	3	657	668	664
Millerton	Large	All	.	2	1						1SW C	1	631	631	631
Millerton	Large	All	2	3	1	2					1SW C+	4	669	740	771
Millerton	Large	All	2	7	1	2	3	4	5	6	1SW C+	1	934	934	934
Millerton	Large	All	3	3	1	2					1SW C+	5	715	749	727
Millerton	Large	All	.	3	1	2					1SW C+	1	774	774	774
Millerton	Large	All	2	3	1						1SW A	5	808	893	856
Millerton	Large	All	3	3	1						1SW A	1	777	777	777
Millerton	Large	All	2	4	1	3					1SW A+	1	855	855	855
Millerton	Large	All	2	3	2						2SW C	6	796	850	827
Millerton	Large	All	3	3	2						2SW C	1	813	813	813
Millerton	Large	All	.	3	2						2SW C	2	833	853	843
Millerton	Large	All	2	4	2	3					2SW C+	17	811	877	843
Millerton	Large	All	2	5	2	3	4				2SW C+	1	880	880	880
Millerton	Large	All	2	6	2	3	4	5			2SW C+	1	944	944	944
Millerton	Large	All	3	4	2	3					2SW C+	5	847	891	867
Millerton	Large	All	.	4	2	3					2SW C+	2	822	871	847
Millerton	Large	All	.	5	2	3					2SW C+	1	950	950	950
Millerton	Large	All	.	5	2	3	4				2SW C+	2	858	914	886
Millerton	Large	All	2	4	2						2SW A	10	971	977	917
Millerton	Large	All	3	4	2						2SW A	5	882	934	902
Millerton	Large	All	.	4	2						2SW A	3	917	976	956
Millerton	Large	All	2	5	2	4					2SW A+	3	930	970	951
Millerton	Large	All	.	5	2	4					2SW A+	1	961	961	961
Total												**649**			
Proportion											**1SW maiden**	**0.03**			
Proportion River Age 2												**0.41**			
Proportion River Age 3												**0.59**			
Proportion River Age 4												**0.00**			
Proportion											**2SW maiden**	**0.83**			
Proportion River Age 2												**0.50**			
Proportion River Age 3												**0.50**			
Proportion River Age 4												**0.00**			
Proportion											**3SW maiden**	**0.00**			
Proportion River Age 2												**1.00**			
Proportion River Age 3												**0.00**			
Proportion River Age 4												**0.00**			
Proportion											**Repeat spawners**	**0.14**			
Proportion											**1SW C**	**0.11**			
Proportion											**1SW C+**	**0.13**			
Proportion											**1SW A**	**0.07**			
Proportion											**1SW A+**	**0.01**			
Proportion											**2SW C**	**0.10**			
Proportion											**2SW C+**	**0.33**			
Proportion											**2SW A**	**0.20**			
Proportion											**2SW A+**	**0.05**			

Table 19. Status of all small salmon catches at the Cassilis trapnet in the Northwest Miramichi estuary in 2011.

Date	Incidental mortality	Released					Total first time catch	Grand total
		Injured	Unsampled	Sampled	Tagged	Recaps		
Jun. 14 - Jun. 20	2				37		39	39
Jun. 21 - Jun. 27		5		14	172	3	191	194
Jun. 28 - Jul. 4	6	3		48	189	3	246	249
Jul. 5 - Jul. 11	4	34	145		178	4	361	365
Jul. 12 - Jul. 18		5	45	23	57	5	130	135
Jul. 19 - Jul. 25		1			15		16	16
Jul. 26 - Aug. 1					35		35	35
Aug. 2 - Aug. 8		1			15		16	16
Aug. 9 - Aug. 15					3		3	3
Aug. 16 - Aug. 22					8	1	8	9
Aug. 23 - Aug. 29					4	1	4	5
Aug. 30 - Sep. 5					8		8	8
Sep. 6 - Sep. 12					17	2	17	19
Sep. 13 - Sep. 19					10		10	10
Sep. 20 - Sep. 26					13		13	13
Sep. 27 - Oct. 3					9	1	9	10
Oct. 4 - Oct. 10					53	13	53	66
Oct. 11 - Oct. 17		1			15	3	16	19
Oct. 18 - Oct. 21					2		2	2
Total	12	50	190	85	840	36	1177	1213

Table 20. Status of all small salmon catches at the Millerton trapnet in Southwest Miramichi estuary in 2011.

Date	Incidental mortality	Released					Total first time catch	Grand total
		Injured	Unsampled	Sampled	Tagged	Recaps		
May 31 - Jun. 6					8		8	8
Jun. 7 - Jun. 13	1		1		27		29	29
Jun. 14 - Jun. 20					33		33	33
Jun. 21 - Jun. 27	2				75	1	78	79
Jun. 28 - Jul. 4		3	1		98	1	103	104
Jul. 5 - Jul. 11	4	2	570	39	210	8	833	841
Jul. 12 - Jul. 18	2	9	85		111	4	211	215
Jul. 19 - Jul. 25	3	10	49		140	10	212	222
Jul. 26 - Aug. 1		2	12		141	4	159	163
Aug. 2 - Aug. 8		2			41	10	53	63
Aug. 9 - Aug. 15					14	1	15	16
Aug. 16 - Aug. 22					9	3	12	15
Aug. 23 - Aug. 29					12	3	15	18
Aug. 30 - Sep. 5					17	1	18	19
Sep. 6 - Sep. 12					32	2	34	36
Sep. 13 - Sep. 19					48	6	54	60
Sep. 20 - Sep. 26					60	9	69	78
Sep. 27 - Oct. 3		1			24	2	27	29
Oct. 4 - Oct. 10					85	9	94	103
Oct. 11 - Oct. 17					22	7	29	36
Oct. 18 - Oct. 21							0	0
Total	12	29	718	39	1207	81	2086	2167

Table 21. Status of all large salmon catches at the Cassilis trapnet in the Northwest Miramichi estuary in 2011.

Date	Incidental mortality	Released					Total first time catch	Grand total
		Injured	Unsampled	Sampled	Tagged	Recaps		
Jun. 14 - Jun. 20	1				2		3	3
Jun. 21 - Jun. 27		1			27		28	28
Jun. 28 - Jul. 4	3				35		38	38
Jul. 5 - Jul. 11	1	5		2	127	2	135	137
Jul. 12 - Jul. 18		2	1	47	47	1	97	98
Jul. 19 - Jul. 25	1	1			11		13	13
Jul. 26 - Aug. 1	1				29	5	30	35
Aug. 2 - Aug. 8		1			13	2	14	16
Aug. 9 - Aug. 15					3	1	3	4
Aug. 16 - Aug. 22		1			10	1	11	12
Aug. 23 - Aug. 29					2		2	2
Aug. 30 - Sep. 5					4	1	4	5
Sep. 6 - Sep. 12					12	1	12	13
Sep. 13 - Sep. 19					5		5	5
Sep. 20 - Sep. 26					7	2	7	9
Sep. 27 - Oct. 3					5		5	5
Oct. 4 - Oct. 10					42	2	42	44
Oct. 11 - Oct. 17					15	3	15	18
Oct. 18 - Oct. 21				1	3	1	4	5
Total	7	11	1	50	399	22	468	490

Table 22. Status of all large salmon catches at the Millerton trapnet in Southwest Miramichi estuary in 2011.

Date	Incidental mortality	Released					Total first time catch	Grand total
		Injured	Unsampled	Sampled	Tagged	Recaps		
May 31 - Jun. 6	2				6		8	8
Jun. 7 - Jun. 13	1				7		8	8
Jun. 14 - Jun. 20					6		6	6
Jun. 21 - Jun. 27	1				34		35	35
Jun. 28 - Jul. 4	1	2			31		34	34
Jul. 5 - Jul. 11	9	10	3	38	187	3	247	250
Jul. 12 - Jul. 18	1	2		1	60	3	64	67
Jul. 19 - Jul. 25	3	9	1		66	3	79	82
Jul. 26 - Aug. 1		3	1		49	2	53	55
Aug. 2 - Aug. 8					20	1	20	21
Aug. 9 - Aug. 15					15	1	15	16
Aug. 16 - Aug. 22					7	2	7	9
Aug. 23 - Aug. 29					5	1	5	6
Aug. 30 - Sep. 5		1			10		11	11
Sep. 6 - Sep. 12					12		12	12
Sep. 13 - Sep. 19			1		24	2	25	27
Sep. 20 - Sep. 26					27	2	27	29
Sep. 27 - Oct. 3					12	1	12	13
Oct. 4 - Oct. 10			1		39	4	40	44
Oct. 11 - Oct. 17					22		22	22
Oct. 18 - Oct. 21			1		5		6	6
Total	18	27	8	39	644	25	736	761

Table 23. Summary of Carlin tags applied to Atlantic salmon in 2011 by age, release date, and location.

	Age	Primary tag	Number tagged	Tag number	Release date	Release location
Northwest Miramichi						
	MSW	Carlin-blue	50	YY27351 - YY27400	July	Northwest Miramichi
	MSW	Carlin-blue	50	YY27451 - YY27500	July / August	Northwest Miramichi
	MSW	Carlin-blue	170	YY30230 - YY30400	June / July	Northwest Miramichi
	1SW	Carlin-blue	258	YY30743 - YY31000	Juune	Northwest Miramichi
	1SW	Carlin-blue	550	YY32001 - YY32550	June to October	Northwest Miramichi
	MSW	Carlin-blue	128	YY34001 - YY34150	Agust to October	Northwest Miramichi
	1SW	Carlin-blue	32	YY34501 - YY34532	October	Northwest Miramichi
	Total		1,238			
Southwest Miramichi						
	MSW	Carlin-blue	13	YY22438 - YY22450	July	Southwest Miramichi
	MSW	Carlin-blue	15	YY22886 - YY22900	July	Southwest Miramichi
	MSW	Carlin-blue	7	YY22994 - YY23000	July	Southwest Miramichi
	MSW	Carlin-blue	49	YY22951 - YY26000	June / July	Southwest Miramichi
	MSW	Carlin-blue	150	YY27151 - YY27300	July	Southwest Miramichi
	MSW	Carlin-blue	197	YY27601 - YY27800	July / August	Southwest Miramichi
	MSW	Carlin-blue	13	YY27851 - YY27863	August	Southwest Miramichi
	1SW	Carlin-blue	217	YY28784 - YY29000	June / July	Southwest Miramichi
	1SW / MSW	Carlin-blue	278	YY29251 - YY29550	July to September	Southwest Miramichi
	MSW	Carlin-blue	24	YY29977 - YY30000	June	Southwest Miramichi
	MSW	Carlin-blue	448	YY32551 - YY33000	July / August	Southwest Miramichi
	1SW	Carlin-blue	749	YY33001 - YY33750	July to September	Southwest Miramichi
	1SW	Carlin-blue	240	YY35001 - YY35243	September / October	Southwest Miramichi
	MSW	Carlin-blue	122	YY35601 - YY35722	September / October	Southwest Miramichi
	Total		2,522			

Table 24. The 44 recapture scenarios observed in 2011 and their frequency for small and large salmon tagged in 2011. Recaptures in bold were used in the hierarchical Bayesian framework to estimate abundance in 2011 (Chaput and Douglas 2012). Numbers preceded by an '*' indicate recapture scenarios where the frequency needs to be doubled to account for both the first and second time the fish was recaptured. Ang = angling, EG = Eel Ground, RB = Red Bank.

Location				Salmon	
Tagging	**Recap 1**	**Recap 2**	**Recap 3**	**Small**	**Large**
NW Cassilis	NW Cassilis	NW Cassilis	NW Cassilis	1	
NW Cassilis	NW Cassilis	NW Cassilis		4	
NW Cassilis	NW Cassilis			19	14
NW Cassilis	LSW Ang			11	3
NW Cassilis	NW Ang			7	1
NW Cassilis	SW Ang				1
NW Cassilis	SW EG Lower			1	
NW Cassilis	SW EG Upper			1	3
NW Cassilis	Juniper Barrier				1
NW Cassilis	**LSW RB**			**11**	**8**
NW Cassilis	**NW Cassilis**	**LSW RB**		**1**	**1**
NW Cassilis	**SW Millerton**			**5**	**2**
NW Cassilis	**SW EG Upper**	**SW Millerton**			**1**
NW Cassilis	**SW Millerton**	**SW Ang**		**1**	
SW EG Lower	SW EG Lower			1	
SW EG Lower	SW EG Upper			2	2
SW EG Lower	SW Ang			2	1
SW EG Lower	Juniper Barrier				1
SW EG Lower	LSW Ang			1	
SW EG Lower	**SW Millerton**			**1**	**4**
SW EG Lower	**NW Cassilis**				**1**
SW EG Upper	SW EG Upper			4	4
SW EG Upper	SW EG Upper	SW Ang		1	
SW EG Upper	Renous Ang			1	
SW EG Upper	SW Ang			4	2
SW EG Upper	SW EG Lower			1	
SW EG Upper	**SW Millerton**			**7**	**3**
SW EG Upper	**SW Millerton**	**SW Millerton**		***1**	
SW EG Upper	**NW Cassilis**			**2**	
SW EG Upper	**NW Cassilis**	**NW Cassilis**		***1**	
SW EG Upper	**LSW RB**			**2**	**1**
SW Millerton	SW Millerton	SW Millerton		4	
SW Millerton	SW Millerton			55	13
SW Millerton	SW EG Upper			5	1
SW Millerton	Juniper Barrier			1	1
SW Millerton	Dungarvon Barrier			1	
SW Millerton	SW Ang			24	10
SW Millerton	Renous Ang			8	1
SW Millerton	Bartibog Ang				1
SW Millerton	NW Ang			1	
SW Millerton	**NW Cassilis**	**NW Cassilis**			***2**
SW Millerton	**NW Cassilis**			**3**	**3**
SW Millerton	**SW Millerton**	**LSW RB**		**1**	
SW Millerton	**LSW RB**			**1**	

Table 25. Total catch of all species by week at trapnets (Enclosure and above RR bridge) operated by Eel Ground First Nation in the Southwest Miramichi estuary in 2011. Large catches of gaspereau in June and July were estimated. Gaspereau is a collective term for alewife and blueback herring when they are not identified to species.

	Species												
Date	sea lamprey	gaspereau	American shad	Atlantic salmon (small)	Atlantic salmon (large)	brook trout	white sucker	American eel	stickleback	white perch	striped bass	flounder	Total
Enclosure													
Jun. 24 - Jun. 30													
Jul. 1 - Jul. 7		1,000	12	213	74		9	1			18		1,327
Jul. 8 - Jul. 14		535	16	127	38	3	5	14			8		746
Jul. 15 - Jul. 21	1	170	3	19	9			16			13		231
Jul. 22 - Jul. 28		125	1	12	16		18	14			31		217
Jul. 29 - Aug. 4		10		7	12						3		32
Aug. 5 - Aug. 11													0
Aug. 12 - Aug. 18				7	7			1			5		20
Aug. 19 - Aug. 25				3	2		2				17		24
Aug. 26 - Sep. 1													
Sep. 2 - Sep. 8													
Sep. 9 - Sep. 15													
Sep. 16 - Sep. 22													
Sep. 23 - Sep. 29													
Sep. 30													
Total	1	1,840	32	388	158	3	34	46	0	0	95	0	2,597
Above RR bridge													
Jun. 24 - Jun. 30													
Jul. 1 - Jul. 7		1,000	5	245	148	4	8	8			15		1,433
Jul. 8 - Jul. 14		1,130	9	222	91	1	19	13			12		1,497
Jul. 15 - Jul. 21		355	3	52	27		3	17			20		477
Jul. 22 - Jul. 28	1	185	2	81	57		30	12		1	53		422
Jul. 29 - Aug. 4		25	2	16	19		1	12			12		87
Aug. 5 - Aug. 11				11	3		1	1			10		26
Aug. 12 - Aug. 18				33	18						47		98
Aug. 19 - Aug. 25				8	10		15				59		92
Aug. 26 - Sep. 1				9	13						5	1	28
Sep. 2 - Sep. 8				18	11		1				9		39
Sep. 9 - Sep. 15				37	12		1			1	9		60
Sep. 16 - Sep. 22													
Sep. 23 - Sep. 29													
Sep. 30													
Total	1	2,695	21	732	409	5	79	63	0	2	251	1	4,259

Table 26. Total catch of all species during trapnet operations at Red Bank Northwest (upper) and Red Bank Little Southwest (lower) sites on the Northwest Miramichi in 2011. Gaspereau is a collective term for alewife and blueback herring when they are not identified to species.

	Species												
Date	sea lamprey	gaspereau	American shad	Atlantic salmon (small)	Atlantic salmon (large)	brook trout	white sucker	American eel	stickleback	white perch	striped bass	flounder	Total
Red Bank NW													
Jun. 24 - Jun. 30													
Jul. 1 - Jul. 7													
Jul. 8 - Jul. 14													
Jul. 15 - Jul. 21							6						6
Jul. 22 - Jul. 28		4		3	1		5				2		15
Jul. 29 - Aug. 4													0
Aug. 5 - Aug. 11													0
Aug. 12 - Aug. 18													0
Aug. 19 - Aug. 25	1			1									2
Aug. 26 - Sep. 1													
Sep. 2 - Sep. 8													
Sep. 9 - Sep. 15													
Sep. 16 - Sep. 22													
Sep. 23 - Sep. 29													
Sep. 30													
Total	1	4	0	4	1	0	11	0	0	0	2	0	23
Red Bank LSW													
Jun. 24 - Jun. 30				13	1								14
Jul. 1 - Jul. 7		2,025	4	74	20	1	13						2,137
Jul. 8 - Jul. 14	1	900	6	112	74		17		3		6		1,119
Jul. 15 - Jul. 21		187		55	49		13	1		1	10		316
Jul. 22 - Jul. 28	1	79		46	31		8				6		171
Jul. 29 - Aug. 4		25	1	19	30						4		79
Aug. 5 - Aug. 11													0
Aug. 12 - Aug. 18				3	2		1				1		7
Aug. 19 - Aug. 25				18	17		1				2		38
Aug. 26 - Sep. 1				1	2		9						12
Sep. 2 - Sep. 8													0
Sep. 9 - Sep. 15		1		9	8						1		19
Sep. 16 - Sep. 22				29	15		2				1		47
Sep. 23 - Sep. 29				15	12		2				7		36
Sep. 30				1	1								2
Total	2	3,217	11	395	262	1	66	1	3	1	38	0	3,997

Table 27. Summary of 2011 angler tag returns that were initially applied at the DFO index trapnet at Cassilis in the Northwest Miramichi estuary. The symbol 'na' denotes not available due to missing information with the tag return. Similarly, the recapture location has been identified as 'Unknown' when it wasn't provided.

	Tagging			Recapture		Recapture location					
Life stage	Location	Year	Month	Year	Month	LSW	NW	Renous	SW	Other	Total
1SW	NW Cassilis	2009	Oct	2011	May		1				1
	NW Cassilis	2010	Jun	2011	Apr		1				1
	NW Cassilis	2010	Jul	2011	Apr				2		2
	NW Cassilis	2010	Aug	2011	Apr				1		1
	NW Cassilis	2010	Sep	2011	Apr	1			5		6
	NW Cassilis	2010	Sep	2011	May	1					1
	NW Cassilis	2010	Oct	2011	Apr				1		1
	NW Cassilis	2010	Nov	2011	Oct	1					1
	NW Cassilis	2011	Jun	2011	Jun	3					3
	NW Cassilis	2011	Jun	2011	Jul	1	3				4
	NW Cassilis	2011	Jun	2011	Aug		1				1
	NW Cassilis	2011	Jul	2011	Jul	4	3				7
	NW Cassilis	2011	Jul	2011	Aug	1					1
	NW Cassilis	2011	Jul	2011	Sep				1		1
	NW Cassilis	2011	Jul	2011	na					1	1
	NW Cassilis	2011	Sep	2011	Oct	1					1
	NW Cassilis	2011	Oct	2011	Oct	1					1
Total						**14**	**9**	**0**	**10**	**1**	**34**
Proportion						**0.41**	**0.26**	**0.00**	**0.29**	**0.03**	
MSW	NW Cassilis	2009	Jul	2011	Apr		1				1
	NW Cassilis	2010	Jun	2011	Apr	1					1
	NW Cassilis	2010	Aug	2011	Apr				2		2
	NW Cassilis	2010	Sep	2011	Apr				1		1
	NW Cassilis	2010	Oct	2011	Apr				1		1
	NW Cassilis	2010	Oct	2011	May				1		1
	NW Cassilis	2011	Jun	2011	Jul		1				1
	NW Cassilis	2011	Jul	2011	Nov	1					1
	NW Cassilis	2011	Aug	2011	Sep				1		1
	NW Cassilis	2011	Aug	2011	Oct	1					1
	NW Cassilis	2011	Oct	2011	Oct	1					1
Total						**4**	**2**	**0**	**6**	**0**	**12**
Proportion						**0.33**	**0.17**	**0.00**	**0.50**	**0.00**	

Table 28. Summary of 2011 angler tag returns that were initially applied at the DFO index trapnet at Millerton or at one of the two trapnets operated by Eel Ground First Nation in the Southwest Miramichi estuary. 'Other' refers to a Miramichi River tributary below the confluence of the Northwest and Southwest Miramichi rivers (i.e. Bartibog, Napan, Tabusintac etc.).

	Tagging			Recapture		Recapture location					
Life stage	Location	Year	Month	Year	Month	LSW	NW	Renous	SW	Other	Total
1SW	SW Eel Ground	2010	Aug	2011	Apr				1		1
	SW Eel Ground	2010	Sep	2011	May				2		2
	SW Millerton	2010	Jul	2011	Apr				2		2
	SW Millerton	2010	Sep	2011	Apr	1					1
	SW Millerton	2010	Oct	2011	Apr				1		1
	SW Millerton	2010	Jun	2011	Jul				1		1
	SW Eel Ground	2011	Jul	2011	Jul			1			1
	SW Eel Ground	2011	Jul	2011	Aug	1					1
	SW Eel Ground	2011	Jul	2011	Sep				2		2
	SW Eel Ground	2011	Aug	2011	Aug				1		1
	SW Eel Ground	2011	Aug	2011	Sep				2		2
	SW Eel Ground	2011	Sep	2011	Sep				2		2
	SW Millerton	2011	Jun	2011	Jun			3			3
	SW Millerton	2011	Jun	2011	Jul			1	2		3
	SW Millerton	2011	Jul	2011	Apr				1		1
	SW Millerton	2011	Jul	2011	Jul			2	6		8
	SW Millerton	2011	Jul	2011	Aug		1	1	6		8
	SW Millerton	2011	Jul	2011	Oct			2	1		3
	SW Millerton	2011	Aug	2011	Aug				2		2
	SW Millerton	2011	Aug	2011	Oct				1		1
	SW Millerton	2011	Aug	2011	na				1		1
	SW Millerton	2011	Sep	2011	Sep				2		2
	SW Millerton	2011	Sep	2011	Oct				3		3
Total						**2**	**1**	**10**	**39**	**0**	**52**
Proportion						**0.04**	**0.02**	**0.19**	**0.75**	**0.00**	
MSW	SW Eel Ground	2010	Jul	2011	Apr	1			1		2
	SW Eel Ground	2010	Aug	2011	May				1		1
	SW Millerton	2010	Jul	2011	Apr				2		2
	SW Millerton	2010	Aug	2011	Sep				1		1
	SW Eel Ground	2011	Jul	2011	Jul					1	1
	SW Eel Ground	2011	Jul	2011	Aug				2		2
	SW Eel Ground	2011	Jul	2011	Oct				1		1
	SW Millerton	2011	Jun	2011	Jun			1			1
	SW Millerton	2011	Jul	2011	Jul				3		3
	SW Millerton	2011	Jul	2011	Aug				3		3
	SW Millerton	2011	Jul	2011	Oct				1		1
	SW Millerton	2011	Sep	2011	Sep				2		2
	SW Millerton	2011	Sep	2011	Oct				1	1	2
Total						**1**	**0**	**1**	**18**	**2**	**22**
Proportion						**0.05**	**0.00**	**0.05**	**0.82**	**0.09**	

Table 29. Counts of large and small Atlantic salmon to a headwater protection barrier on the Northwest Miramichi River, the Dungarvon River, and the North Branch of the Southwest Miramichi River near Juniper for years 1984 to 2011. Numbers in italics represent information that was collected when the barrier facility was only operating partially (data provided by NB DNR and JD Irving Ltd.).

	Large salmon			Small salmon		
Year	Northwest	Dungarvon	Juniper	Northwest	Dungarvon	Juniper
1984		93	297		315	230
1985		162	604		536	492
1986		174	1138		501	2072
1987		202	1266		744	1175
1988	234	277	929	1614	851	1092
1989	287	315	731	966	579	969
1990	331	318	994	1318	562	1646
1991	224	204	476	765	296	495
1992	219	232	1047	1165	825	1383
1993	216	223	1145	1034	659	1349
1994	228	155	905	673	358	1195
1995	252	95	1019	548	329	811
1996	218	184	819	602	590	1388
1997	152	115	519	501	391	566
1998	289	163	698	1038	592	981
1999	387	185	698	708	378	566
2000	217	130	725	456	372	1202
2001	202	111	904	344	295	729
2002	121	107	546	595	287	1371
2003	186	158	920	478	389	912
2004	167	185	764	723	559	1368
2005	262	300	673	735	441	853
2006	214	217	*829*	469	468	*860*
2007	166	88	783	460	195	945
2008	164	131	692	1094	673	1083
2009	206	234	770	315	207	245
2010	284	228	*563	852	660	*307
2011	298	327	*381	996	712	*268
Overall average (84-10)	227	185	795	759	483	974
2011 relative to overall average	31%	77%	-52%	31%	47%	-72%
Previous 5 yr. average (06-10)	207	180	727	638	441	688
2011 relative to previous 5 yr. average	44%	82%	-48%	56%	62%	-61%

Table 30. Estimates of juvenile Atlantic salmon density, percent habitat saturation (PHS), and biomass by age for all electrofishing sites sampled in 2011.

			Density (fish/100m^2)			PHS				Biomass (g)			
Date	**Site**	**Location**	**Age 0+**	**Age 1+**	**Age 2+**	**Age 0+**	**Age 1+**	**Age 2+**	**Total**	**Age 0+**	**Age 1+**	**Age 2+**	**Total**
		Little Southwest Miramichi R.											
14-Sep	43	LSW - Sillikers	23.9	5.2	0.0	4.1	2.9		7.1	50.9	46.0	0.0	97.0
14-Sep	44	LSW - Parks brook	58.0	14.3	3.9	8.7	6.8	4.0	19.5	105.0	99.4	70.5	274.9
15-Sep	45	LSW - Moose landing	76.0	4.9	3.7	11.3	3.1	3.4	17.9	144.0	50.1	52.8	246.8
27-Sep	46	LSW - Catamaran bk	1.3	3.0	6.1	0.3	1.8	7.3	9.4	3.5	27.9	132.5	163.8
15-Sep	107	LSW - Tuadook	9.2	0.0	2.8	2.0		3.8	5.8	26.7	0.0	68.9	95.7
15-Sep	145	Northpole stream	48.8	18.5	8.4	8.3	11.9	10.5	30.8	104.2	183.3	181.0	468.5
26-Sep	147	LSW - Lower North br	101.0	35.8	5.1	10.2	15.6	4.6	30.5	118.4	228.4	75.1	421.8
27-Sep	218	LSW - Tractors & Equip	34.9	18.5	2.6	4.8	8.3	3.1	16.3	58.8	119.6	53.1	231.4
		Northwest Miramichi R.											
13-Sep	23	NW - Sutherland bk	87.4	37.0	11.5	14.5	18.7	13.6	46.9	175.7	288.9	231.6	696.3
28-Sep	26	NW - Curventon	8.8	8.0	2.7	1.7	4.5	2.2	8.4	22.1	68.5	37.8	128.4
13-Sep	30	NW - Allison	17.9	9.5	1.4	2.8	4.7	1.5	8.9	32.9	71.1	24.4	128.4
13-Sep	33	NW - Camp Adams	80.4	61.0	11.9	10.0	24.9	12.1	47.0	123.7	357.4	186.7	667.8
17-Sep	34	NW - Crawford	157.9	83.9	12.0	18.8	37.8	12.2	68.8	228.1	571.5	206.2	1005.8
12-Sep	35	NW - South br	194.5	78.1	17.1	23.9	35.9	18.9	78.7	291.0	549.6	301.6	1142.1
12-Sep	38	Sevogle - North br	44.3	57.3	13.7	6.8	26.2	13.6	46.6	84.8	397.3	230.5	712.6
14-Sep	39	Sevogle South br	61.1	12.9	1.3	7.2	5.4	2.0	14.5	91.5	76.4	36.6	204.5
28-Sep	40	Little Sevogle	32.4	4.5	5.3	4.2	2.6	6.8	13.6	54.7	43.3	125.3	223.3
26-Sep	103	Mullinstream	20.4	12.9	5.2	3.5	6.7	5.3	15.4	47.6	100.4	93.2	241.2
23-Sep	113	Tomogonops	7.0	36.0	1.3	1.2	16.2	1.3	18.7	16.3	254.7	19.4	290.4
23-Sep	115	NW - Miners	37.3	48.5	16.2	6.0	22.9	15.9	44.8	79.2	359.0	267.9	706.1
9-Sep	135	NW Millstream	10.4	0.0	3.9	2.3		3.9	6.2	31.5	0.0	67.4	98.9
14-Sep	153	Sevogle - South br	49.4	28.5	5.2	5.8	12.3	5.6	23.7	63.0	184.1	86.9	334.0
26-Sep	190	Sevogle - McTurk	32.0	12.1	1.3	5.7	7.1	1.2	14.0	71.9	109.3	18.3	199.6
9-Sep	191	NW - Trout bk	29.4	6.2	0.0	5.0	3.5		8.5	59.5	52.9	0.0	112.3
23-Sep	215	NW - Wayerton	37.9	16.6	4.4	5.8	7.8	5.3	18.9	73.8	131.1	87.9	292.9
23-Sep	216	NW - Big Hole Tract	15.5	2.6	0.0	2.8	1.6		4.4	36.2	25.3	0.0	61.5
		Renous R.											
30-Sep	48	Renous - McGraw bk	100.8	35.1	8.8	14.5	13.8	10.1	38.3	194.8	204.8	177.0	576.6
29-Sep	54	Renous - North br	36.9	15.3	3.8	5.7	7.3	4.8	17.8	72.3	111.5	79.4	263.1
29-Sep	55	Dungarvon - R&S	38.6	6.7	4.0	6.2	3.0	4.3	13.5	80.4	41.6	75.1	197.0
29-Sep	57	Dungarvon - Furlong	26.7	9.5	0.0	3.8	4.1		7.9	48.2	60.3	0.0	108.5
30-Sep	186	Dungarvon - Halfway	74.5	21.1	6.6	9.4	10.6	7.0	26.9	124.8	175.9	125.6	426.3
30-Sep	210	Dungarvon - Holtville	100.3	66.3	8.5	12.7	28.3	8.8	49.8	160.7	438.1	144.4	743.2
		Southwest Miramichi R.											
21-Sep	65	SW - South br	129.1	0.0	5.7	21.7		5.4	27.2	268.5	0.0	83.5	352.0
21-Sep	69	SW - Biggar bk	13.5	7.7	11.5	2.5	3.9	12.2	18.6	33.5	59.6	212.1	305.2
22-Sep	74	Cains - Sabies	191.9	29.5	8.7	28.6	17.2	8.9	54.7	365.1	279.4	147.1	791.5
16-Sep	75	Cains - Shinnikburn	15.7	1.3	0.0	2.4	0.8		3.2	28.1	11.0	0.0	39.1
16-Sep	77	Cains - Leighton bk	26.7	8.9	2.5	4.5	5.1	2.6	12.2	58.2	82.6	45.0	185.8
16-Sep	78	Cains - Grand Lake	55.3	9.3	0.0	9.6	4.9		14.5	119.3	75.9	0.0	195.2
20-Sep	79	SW - Big Hole bk	23.8	6.5	1.3	4.4	4.0	1.2	9.6	54.4	62.0	16.0	132.4
19-Sep	82	SW - Betts Mill bk	114.1	15.6	7.2	17.0	9.5	8.1	34.6	204.2	143.5	137.6	485.3
19-Sep	84	SW - Burntland bk	82.2	23.7	6.2	15.1	13.3	6.4	34.8	185.0	198.3	102.7	486.0
19-Sep	86	Taxis - Stewart bk	40.3	10.2	7.6	7.7	5.6	9.7	23.0	91.6	84.5	167.7	343.7
19-Sep	88	Taxis - Hayden bk	13.0	18.6	12.4	3.2	11.4	12.8	27.4	38.3	171.0	214.4	423.7
20-Sep	98	Barnaby - Collette	0.0	3.9	28.8		2.0	31.8	33.7	0.0	29.4	530.8	560.1
21-Sep	129	SW - McKiel bk	13.6	41.4	7.8	2.0	23.5	9.1	34.6	22.7	359.8	159.7	542.2
20-Sep	131	Barnaby	15.5	1.3	9.1	2.5	0.9	10.1	13.5	30.4	13.7	175.3	219.4
21-Sep	206	SW - Elliott bk	111.6	11.7	2.6	19.9	7.0	2.6	29.5	265.8	121.2	45.2	432.3
22-Sep	213	Cains - Fergusons Is	69.9	1.3	1.3	11.7	1.0	1.1	13.8	153.8	15.9	17.9	187.6
20-Sep	220	Cains - Six mile bk	65.5	24.9	3.9	9.6	13.9	5.3	28.7	111.9	218.3	88.1	418.2

Table 31. Average fork length, weight, and condition factor by age for juvenile Atlantic salmon sampled at all electrofishing sites in 2011.

			Fork length (mm)			Weight (g)			Condition factor		
Date	Site	Location	Age 0+	Age 1+	Age 2+	Age 0+	Age 1+	Age 2+	Age 0+	Age 1+	Age 2+
20-Sep	131	Barnaby	56.1	99.0	118.0	2.0	10.5	19.2	1.1	1.1	1.2
20-Sep	98	Barnaby - Collette		87.3	117.9		7.5	18.4		1.1	1.1
22-Sep	213	Cains - Fergusons Is	57.3	102.0	105.0	2.2	12.0	13.5	1.2	1.1	1.2
16-Sep	78	Cains - Grand Lake	58.0	88.8		2.2	8.1		1.1	1.2	
16-Sep	77	Cains - Leighton bk	57.6	92.1	114.0	2.2	9.3	17.8	1.1	1.2	1.2
22-Sep	74	Cains - Sabies	54.8	92.4	114.2	1.9	9.5	16.9	1.2	1.2	1.1
16-Sep	75	Cains - Shinnikburn	55.4	92.0		1.8	8.3		1.0	1.1	
20-Sep	220	Cains - Six mile bk	54.4	90.8	127.0	1.7	8.8	22.4	1.1	1.2	1.1
29-Sep	57	Dungarvon - Furlong	53.9	82.4		1.8	6.3		1.2	1.1	
30-Sep	186	Dungarvon - Halfway	51.3	87.3	116.4	1.7	8.4	19.1	1.2	1.3	1.2
30-Sep	210	Dungarvon - Holtville	51.4	82.0	115.2	1.6	6.6	17.1	1.2	1.2	1.1
29-Sep	55	Dungarvon - R&S	56.5	83.2	116.7	2.1	6.2	18.8	1.2	1.1	1.2
30-Sep	48	Renous - McGraw bk	54.1	79.3	119.7	1.9	5.8	20.2	1.2	1.2	1.2
29-Sep	54	Renous - North br	55.5	85.8	123.7	2.0	7.3	20.8	1.1	1.2	1.1
27-Sep	46	LSW - Catamaran bk	63.0	92.0	122.0	2.6	9.2	21.8	1.0	1.2	1.2
26-Sep	147	LSW - Lower North br	47.2	82.7	109.5	1.2	6.4	14.7	1.1	1.1	1.1
15-Sep	45	LSW - Moose landing	54.8	95.5	110.7	1.9	10.2	14.3	1.2	1.2	1.1
14-Sep	44	LSW - Parks brook	54.9	85.6	114.7	1.8	7.0	18.1	1.1	1.1	1.2
14-Sep	43	LSW - Sillikers	58.0	91.5		2.1	8.9		1.1	1.2	
27-Sep	218	LSW - Tractors & Equip	53.1	83.6	121.0	1.7	6.5	20.1	1.1	1.1	1.1
15-Sep	107	LSW - Tuadook	63.6		128.0	2.9		24.8	1.1		1.2
15-Sep	145	Northpole stream	57.7	95.9	123.8	2.1	9.9	21.5	1.1	1.1	1.1
13-Sep	30	NW - Allison	55.6	86.6	117.0	1.8	7.5	18.0	1.1	1.2	1.1
23-Sep	216	NW - Big Hole Tract	59.2	94.5		2.3	9.7		1.1	1.1	
13-Sep	33	NW - Camp Adams	51.1	80.6	114.3	1.5	5.9	15.6	1.2	1.1	1.0
17-Sep	34	NW - Crawford	50.3	83.7	114.5	1.4	6.8	17.2	1.1	1.2	1.1
28-Sep	26	NW - Curventon	61.0	91.3	105.0	2.5	8.6	14.2	1.1	1.1	1.2
23-Sep	115	NW - Miners	56.4	85.2	112.8	2.1	7.4	16.6	1.2	1.2	1.2
12-Sep	35	NW - South br	50.9	84.3	118.2	1.5	7.0	17.7	1.1	1.2	1.1
13-Sep	23	NW - Sutherland bk	57.1	87.4	121.3	2.0	7.8	20.2	1.1	1.2	1.1
9-Sep	191	NW - Trout bk	57.4	91.6		2.0	8.5		1.1	1.1	
23-Sep	215	NW - Wayerton	55.4	84.9	121.3	1.9	7.9	19.9	1.1	1.3	1.1
9-Sep	135	NW Millstream	63.7		113.7	3.0		17.1	1.2		1.2
26-Sep	103	Mullinstream	57.7	88.2	114.8	2.3	7.8	18.1	1.2	1.1	1.2
23-Sep	113	Tomogonops	58.5	83.8	111.0	2.3	7.1	14.6	1.2	1.2	1.1
26-Sep	190	Sevogle - McTurk	58.5	92.4	110.0	2.3	9.0	13.6	1.1	1.1	1.0
12-Sep	38	Sevogle - North br	55.4	84.2	113.4	1.9	6.9	16.8	1.1	1.2	1.2
14-Sep	153	Sevogle - South br	50.0	82.5	116.8	1.3	6.5	16.8	1.0	1.2	1.1
14-Sep	39	Sevogle South br	49.9	81.2	134.0	1.5	5.9	28.4	1.2	1.1	1.2
28-Sep	40	Little Sevogle	52.1	91.3	124.9	1.7	9.6	23.8	1.2	1.3	1.2
19-Sep	82	SW - Betts Mill bk	54.8	93.8	118.7	1.8	9.2	19.1	1.1	1.1	1.1
20-Sep	79	SW - Big Hole bk	59.6	94.8	109.0	2.3	9.6	12.4	1.1	1.1	1.0
21-Sep	69	SW - Biggar bk	59.3	87.5	116.2	2.5	7.8	18.4	1.2	1.2	1.2
19-Sep	84	SW - Burntland bk	59.4	91.0	114.8	2.3	8.4	16.5	1.1	1.1	1.1
21-Sep	206	SW - Elliott bk	58.7	93.0	114.0	2.4	10.3	17.4	1.2	1.3	1.2
21-Sep	129	SW - McKiel bk	54.9	91.4	120.5	1.7	8.7	20.6	1.0	1.1	1.2
21-Sep	65	SW - South br	57.4		111.6	2.1		14.7	1.1		1.1
19-Sep	88	Taxis - Hayden bk	66.5	94.1	115.1	2.9	9.2	17.3	1.0	1.1	1.1
19-Sep	86	Taxis - Stewart bk	60.3	90.5	124.5	2.3	8.3	21.9	1.0	1.1	1.1

Table 32. Catch and biological characteristics by site of species other than Atlantic salmon captured in the 2011 electrofishing survey of the Miramichi watershed.

			Length (mm)			Weight (g)		
Species	**Site**	**Qty**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**
American eel	145	1	210	210	210	14.5	14.5	14.5
American eel	218	1	150	150	150	5.1	5.1	5.1
Blacknose dace	26	4	26	53	38	0.2	2.0	0.8
Blacknose dace	30	21	20	51	35	0.1	1.6	0.6
Blacknose dace	40	3	60	64	62	2.9	4.9	3.7
Blacknose dace	43	21	39	74	48	0.6	4.2	1.3
Blacknose dace	44	3	32	58	49	0.2	2.0	0.8
Blacknose dace	45	1	55	55	55	1.7	1.7	1.7
Blacknose dace	48	9	25	65	47	0.3	3.9	1.8
Blacknose dace	54	16	28	64	50	0.3	3.0	1.6
Blacknose dace	55	3	29	65	47	0.2	3.6	1.6
Blacknose dace	57	26	24	60	46	0.1	3.2	1.4
Blacknose dace	65	13	25	68	51	0.2	4.2	2.0
Blacknose dace	69	27	20	70	49	0.2	4.3	1.5
Blacknose dace	74	2	50	62	56	1.2	3.2	2.2
Blacknose dace	75	35	25	66	48	0.2	3.2	1.2
Blacknose dace	77	4	49	67	56	1.1	3.4	1.9
Blacknose dace	78	7	45	67	54	0.9	3.3	1.9
Blacknose dace	82	1	55	55	55	3.2	3.2	3.2
Blacknose dace	84	23	45	75	58	0.9	4.8	2.2
Blacknose dace	86	11	47	68	60	1.0	3.6	2.4
Blacknose dace	88	3	62	65	63	2.6	2.8	2.7
Blacknose dace	98	78	39	75	54	0.6	32.0	2.5
Blacknose dace	103	20	31	67	53	0.4	3.7	2.0
Blacknose dace	107	3	25	50	41	0.1	1.7	1.1
Blacknose dace	113	12	20	62	32	0.1	3.3	0.7
Blacknose dace	115	9	21	48	32	0.1	1.5	0.6
Blacknose dace	129	1	71	71	71	4.0	4.0	4.0
Blacknose dace	131	16	31	65	50	0.2	2.9	1.5
Blacknose dace	135	8	45	74	61	0.8	3.8	2.6
Blacknose dace	190	9	31	68	50	0.2	3.8	1.6
Blacknose dace	191	17	49	78	65	1.2	5.9	3.4
Blacknose dace	206	5	43	65	53	0.8	3.3	1.9
Blacknose dace	210	9	27	62	43	0.2	2.9	1.0
Blacknose dace	213	1	42	42	42	0.8	0.8	0.8
Blacknose dace	215	11	23	57	38	0.2	2.8	1.0
Blacknose dace	216	35	20	56	34	0.1	2.4	0.7
Blacknose dace	220	4	47	66	56	1.1	3.1	1.9
Brook trout	23	8	58	176	94	1.9	55.2	15.3
Brook trout	34	2	99	144	122	9.1	31.3	20.2
Brook trout	35	8	55	140	96	2.3	26.3	14.6
Brook trout	40	1	164	164	164	59.2	59.2	59.2
Brook trout	46	7	65	145	101	3.1	44.2	18.1
Brook trout	82	2	68	69	69	3.3	3.4	3.4
Brook trout	98	1	134	134	134	26.5	26.5	26.5
Brook trout	129	1	61	61	61	2.3	2.3	2.3
Brook trout	135	2	74	220	147	3.9	126.3	65.1
Brook trout	147	1	90	90	90	6.4	6.4	6.4
Brook trout	153	1	155	155	155	43.0	43.0	43.0
Brook trout	186	6	56	143	92	2.0	32.1	11.8
Brook trout	191	8	60	192	111	1.9	83.9	22.6
Common shiner	26	2	40	50	45	0.7	1.4	1.1
Common shiner	45	3	33	38	36	0.3	0.6	0.4
Common shiner	54	2	90	92	91	9.5	10.3	9.9
Common shiner	69	7	20	58	31	0.1	2.8	0.7
Common shiner	75	2	22	38	30	0.1	0.3	0.2
Common shiner	77	2	73	75	74	4.8	4.9	4.9
Common shiner	78	1	65	65	65	2.9	2.9	2.9
Common shiner	86	4	63	87	75	2.6	7.7	4.8
Common shiner	98	5	47	62	55	1.1	2.7	1.6
Common shiner	131	10	23	90	45	0.1	8.9	1.6
Common shiner	190	1	54	54	54	1.8	1.8	1.8
Common shiner	213	3	32	37	34	0.3	0.5	0.4
Common shiner	216	12	20	51	40	0.1	1.9	0.9
Lake chub	43	2	64	75	70	3.8	4.5	4.2
Lake chub	86	1	120	120	120	21.8	21.8	21.8
Sea lamprey	23	1	147	147	147	5.2	5.2	5.2
Sea lamprey	40	2	142	145	144	4.4	4.9	4.7
Sea lamprey	43	1	97	97	97	1.4	1.4	1.4
Sea lamprey	210	1	138	138	138	4.0	4.0	4.0
Slimy sculpin	23	25	24	82	54	0.3	7.6	3.0
Slimy sculpin	46	12	39	90	64	0.7	7.9	3.3
Slimy sculpin	65	1	40	40	40	0.9	0.9	0.9
Slimy sculpin	77	4	38	72	58	0.4	4.1	2.3
Slimy sculpin	79	49	28	71	49	0.2	3.9	1.5
Slimy sculpin	82	12	29	85	52	0.2	6.9	2.4
Slimy sculpin	86	1	38	38	38	0.6	0.6	0.6
Slimy sculpin	191	3	52	78	62	1.6	5.4	3.9
Slimy sculpin	206	57	31	80	48	0.3	5.5	1.7
Stickleback spp.	65	4	40	41	40	0.4	0.5	0.4
Stickleback spp.	78	1	49	49	49	0.6	0.6	0.6
Stickleback spp.	98	1	43	43	43	0.7	0.7	0.7
White sucker	40	3	99	118	106	12.9	22.9	16.3
White sucker	216	1	61	61	61	3.1	3.1	3.1

Table 33. Location, deployment, retrieval and sample periods for water temperature data recorders in the Miramichi watershed in 2011.

System	Location	Latitude	Longitude	Deployed		Retrieved		Sample Period	Serial Number
				Date	Time	Date	Time		
SW Miramichi									
	Millerton Estuary DFO Trapnet	46.87775°	-65.66383°	05-May-11	18:00 DST	24-Oct-11	11:00 DST	01:00:00	5139J
	Renuos River	46.80471°	-65.86866°	19-Oct-09	14:00 DST	13-Oct-11	12:00 DST	02:00:00	5142J
	North Branch Renous River	46.79595°	-66.19833°	19-Oct-09	12:00 DST	05-Oct-11	16:00 DST	02:00:00	5143J
	Dungarvon River	46.81621°	-65.90255°	19-Oct-09	12:00 DST	13-Oct-11	12:00 DST	02:00:00	5137J
	Cains River Camp Admerrill	46.65716°	-65.77356°	30-Sep-09	12:00 DST	03-Nov-11	10:00 DST	02:00:00	5135J
	Cains River Shinnickburn	46.51893°	-65.85278°	16-Sep-09	16:00 DST	18-Oct-11	14:00 DST	02:00:00	4769J
	Southwest Miramichi River Wades Lodge	46.67156°	-65.77380°	30-Sep-09	12:00 DST	03-Nov-11	10:00 DST	02:00:00	5136J
	Southwest Miramichi River Nelson Hollow	46.53903°	-66.18808°	16-Sep-09	14:00 DST	04-Oct-11	14:00 DST	02:00:00	4771J
	Burntland Brook	46.46059°	-66.40873°	16-Sep-09	16:00 DST	04-Oct-11	12:00 DST	02:00:00	0678E
	Taxis River	46.42553°	-66.60531°	19-Sep-09	14:00 DST	04-Oct-11	14:00 DST	02:00:00	0677E
NW Miramichi									
	Cassilis Estuary DFO Trapnet	46.93466°	-65.78406°	17-May-11	18:00 DST	25-Oct-11	10:00 DST	01:00:00	5138J
	Big Sevogle River MSA RST	47.04624°	-65.83787°	02-May-11	16:00 DST	05-Jun-11	12:00 DST	01:00:00	5559J
	Northwest Miramichi Trout Brook MSA RST	47.09568°	-65.83742°	02-May-11	15:00 DST	06-Jun-11	9:00 DST	01:00:00	5141J
	Little Southwest Miramichi Upper Oxbow NBSC RST	46.95517°	-65.86046°	04-May-11	00:00 DST	07-Jun-11	10:00 DST	01:00:00	5560J
	Little Southwest Miramichi River Upper Oxbow	46.95456°	-65.85996°	14-Sep-09	16:00 DST	03-Nov-11	12:00 DST	02:00:00	4768J
	Little Southwest Miramichi River Moose Landing	46.96211°	-66.57141°	23-Sep-09	16:00 DST	27-Jul-11	14:00 DST	02:00:00	9811
	Northwest Miramichi Wayerton Bridge	47.13563°	-65.83270°	14-Sep-09	12:00 DST	18-Jul-11	10:00 DST	02:00:00	6806
	Northwest Miramichi Cauls Pool	47.18268°	-65.89462°	14-Sep-09	16:00 DST	13-Oct-11	10:00 DST	02:00:00	4770J
	Tomogonops River	47.23403°	-65.83579°	14-Sep-09	14:00 DST	03-Oct-11	12:00 DST	02:00:00	4772J
	Northwest Miramichi Depot Bridge Pool	47.25676°	-66.22643°	14-Sep-09	14:00 DST	18-Jul-11	12:00 DST	02:00:00	9815
	North Branch Sevogle River Narrows	47.13516°	-65.98351°	14-Sep-09	12:00 DST	18-Jul-11	10:00 DST	02:00:00	3015A

Table 34. Timing and numbers of fish sampled by location during the commercial gaspereau fishery of the Miramichi River in 2011.

	Loggieville			Chatham			Northwest				
	Stage 1	Stage 2		Stage 1	Stage 2		Stage 1			Stage 2	
Date	Combined	Alewife	Blueback	Combined	Alewife	Blueback	Alewife	Blueback	Combined	Alewife	Blueback
30-May	299	36									
2-Jun	221	38	1								
7-Jun	250	28	2	262	22	9	247	30	277	31	17
9-Jun	262	23	6	217	26	3					
10-Jun							262	7	269	32	6
13-Jun							207	54	261	29	21
14-Jun	249	26	12	311	15	20					
16-Jun	227	17	19	233	14	22	126	102	228	27	30
20-Jun				244	15	24	106	154	260	34	28
24-Jun							172	97	269	34	29
Total	1,508	168	40	1,267	92	78	1,120	444	1,564	187	131
Mean	251	28	8	253	18	16	187	74	261	31	22

Table 35. Biological characteristics of alewives and blueback herring by age, and sex sampled in the commercial fishery of the Northwest Miramichi River in 2011.

				Age at first spawning				Fork length (mm)			Weight (g)		
Species	Age	Sex	N	3	4	5	6	Min	Max	Mean	Min	Max	Mean
Alewife	3	Male	61	61				217	253	230	101	177	140
Alewife	3	Female	40	40				228	260	240	120	222	165
Alewife	3	Combined	101	101				217	260	234	101	222	150
Alewife	4	Male	22	1	21			239	272	253	154	257	186
Alewife	4	Female	44		44			244	274	261	159	261	208
Alewife	4	Combined	66	1	65			239	274	258	154	261	201
Alewife	5	Male	4		3	1		253	265	261	178	208	191
Alewife	5	Female	6		1	5		233	253	242	185	278	224
Alewife	5	Combined	10		4	6		253	272	264	178	278	211
Alewife	**All**	**Combined**	**177**	**102**	**69**	**6**		**217**	**274**	**245**	**101**	**278**	**172**
Blueback	3	Male	7	7				215	233	222	103	139	119
Blueback	3	Female	1	1				233	233	233	135	135	135
Blueback	3	Combined	8	8				215	233	223	103	139	121
Blueback	4	Male	7	1	6			230	250	239	145	189	162
Blueback	4	Female	6	3	3			226	271	256	141	331	228
Blueback	4	Combined	13	4	9			226	271	247	141	331	193
Blueback	5	Male	28	4	16	8		232	256	245	139	222	174
Blueback	5	Female	33	1	20	12		231	275	259	161	277	213
Blueback	5	Combined	61	5	36	20		231	275	253	139	277	195
Blueback	6	Male	3		2	1		252	263	259	191	232	207
Blueback	6	Female	8	1	5	1	1	259	285	271	179	305	234
Blueback	6	Combined	11	1	7	2	1	252	285	268	179	305	227
Blueback	7	Female	1	1				279	279	279	217	217	217
Blueback	**All**	**Combined**	**94**	**19**	**52**	**22**	**1**	**215**	**285**	**251**	**103**	**331**	**192**

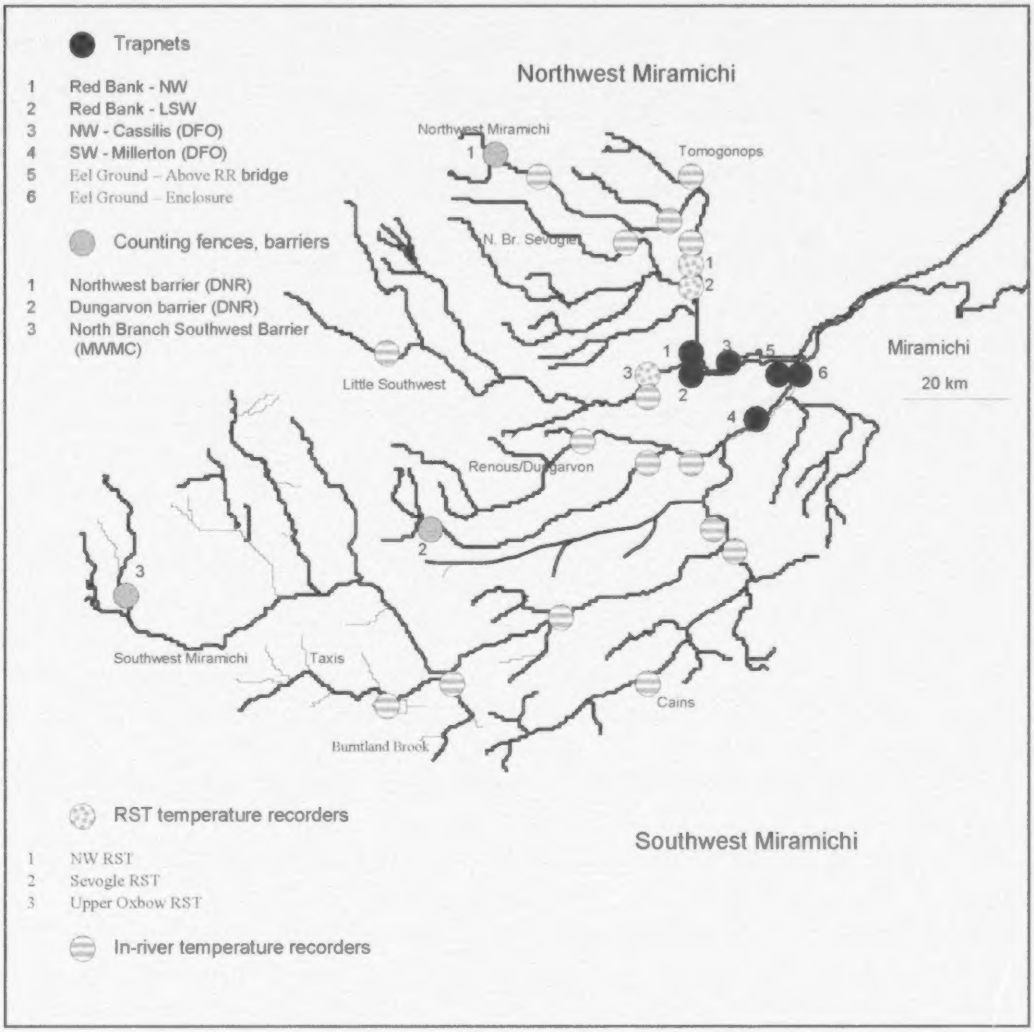


Figure 1. The Miramichi River indicating major branches, tributaries, and locations of trapnets, rotary screw traps, and temperature recorders in 2011.

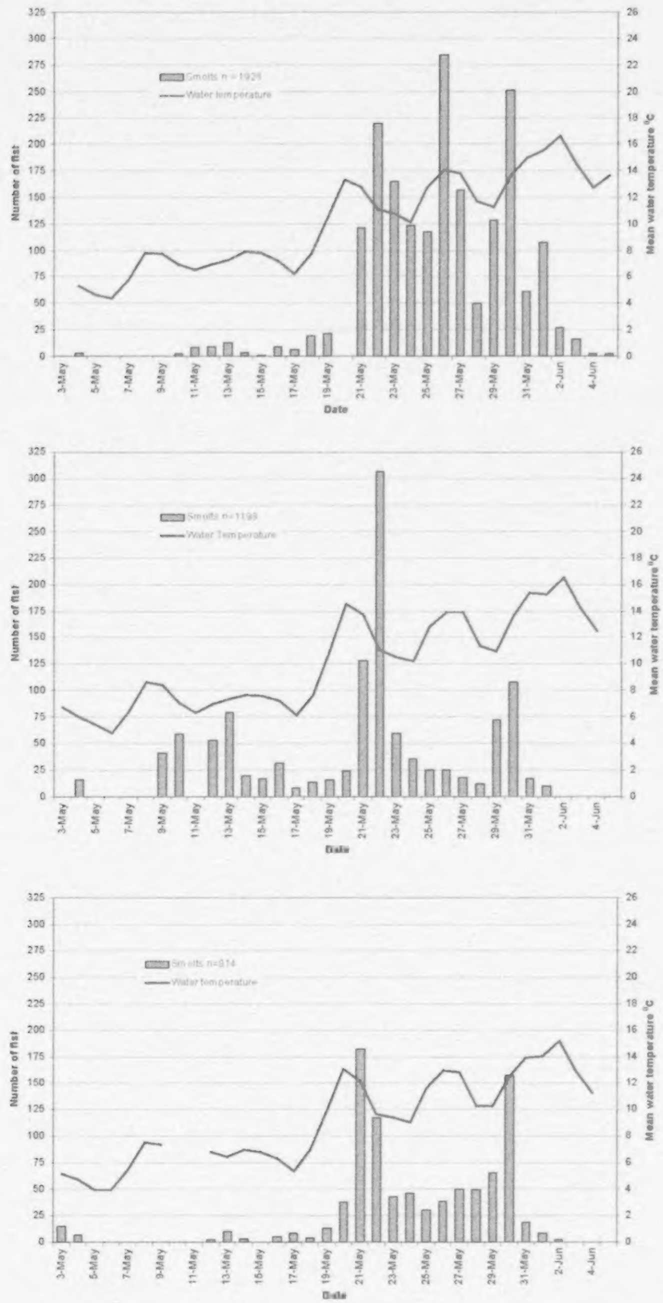


Figure 2. Run timing of smolts from the Little Southwest Miramichi River (upper), the Northwest Miramichi River (middle) and the Big Sevogle River (lower) relative to the daily mean water temperature (solid line) at each location in 2011.

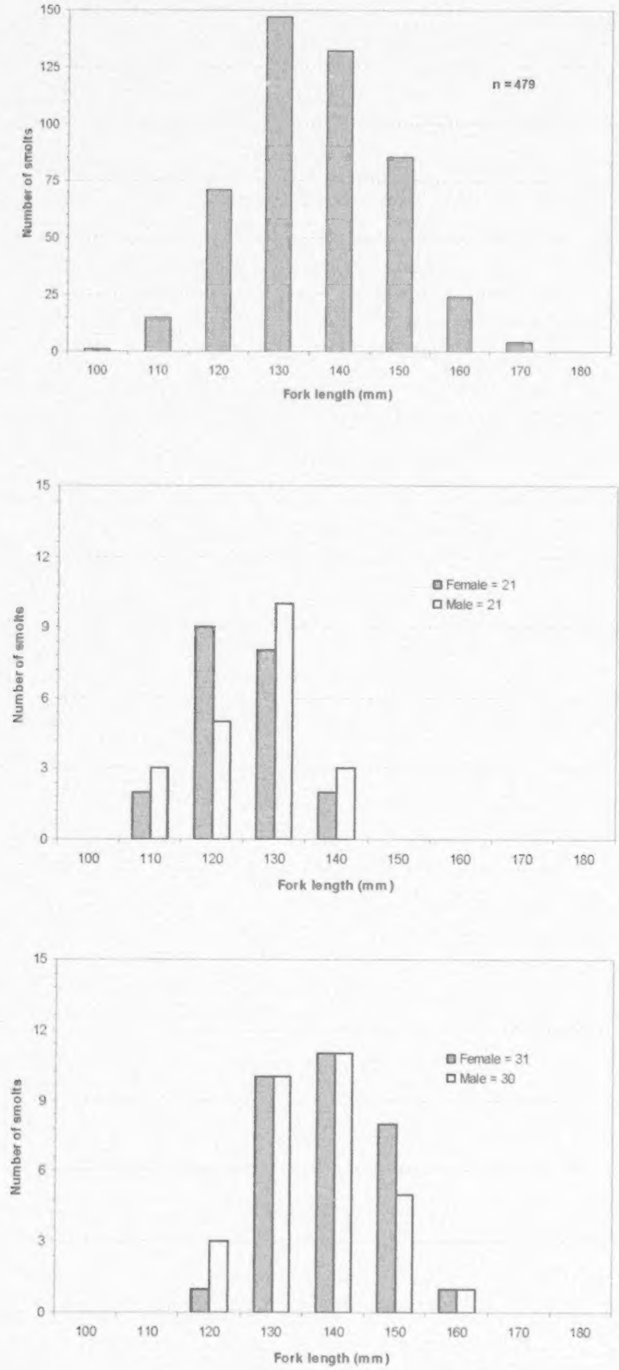
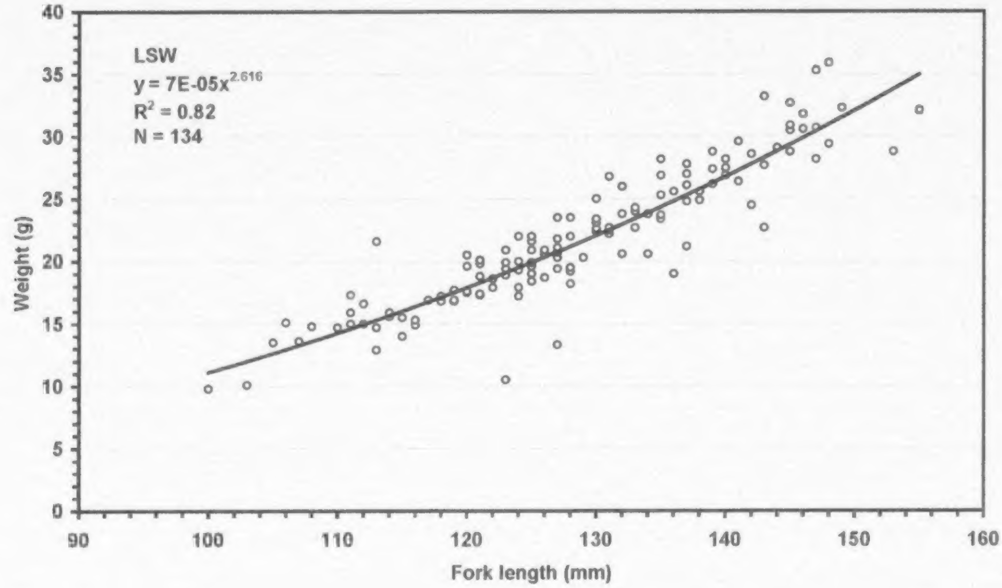


Figure 3. Fork length (mm) distribution of wild smolts sampled at the Oxbow RST in 2011. Upper panel represents all smolts sampled, the middle and bottom panels depict distributions of age 2 and age 3 smolts, by sex, respectively.



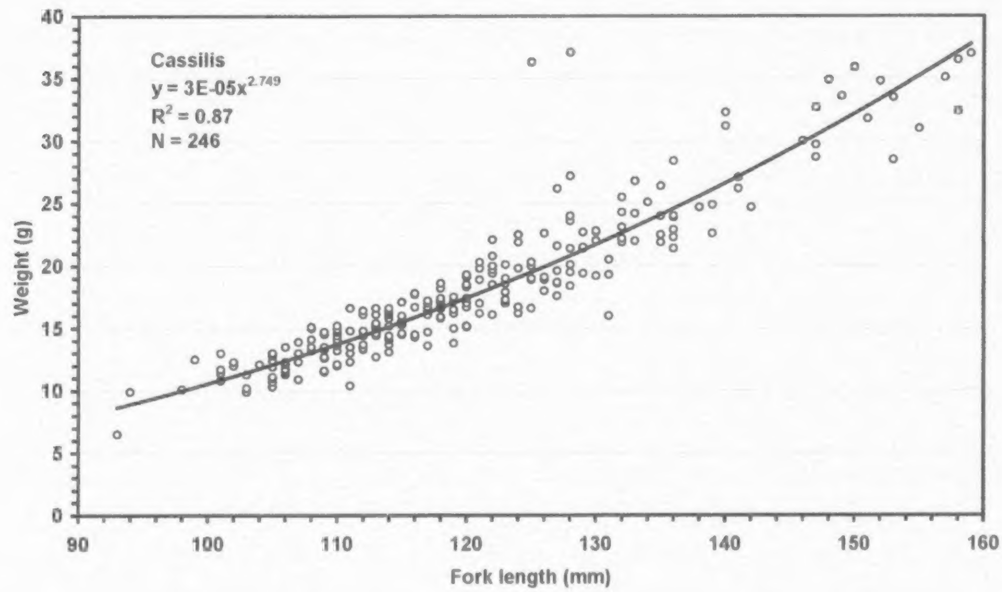


Figure 4. The relationship between thawed fork length and weight for salmon smolts captured in the rotary screw trap in the Little Southwest Miramichi River (upper) and the trapnet at Cassilis in the Northwest Miramichi estuary (lower) in 2011.

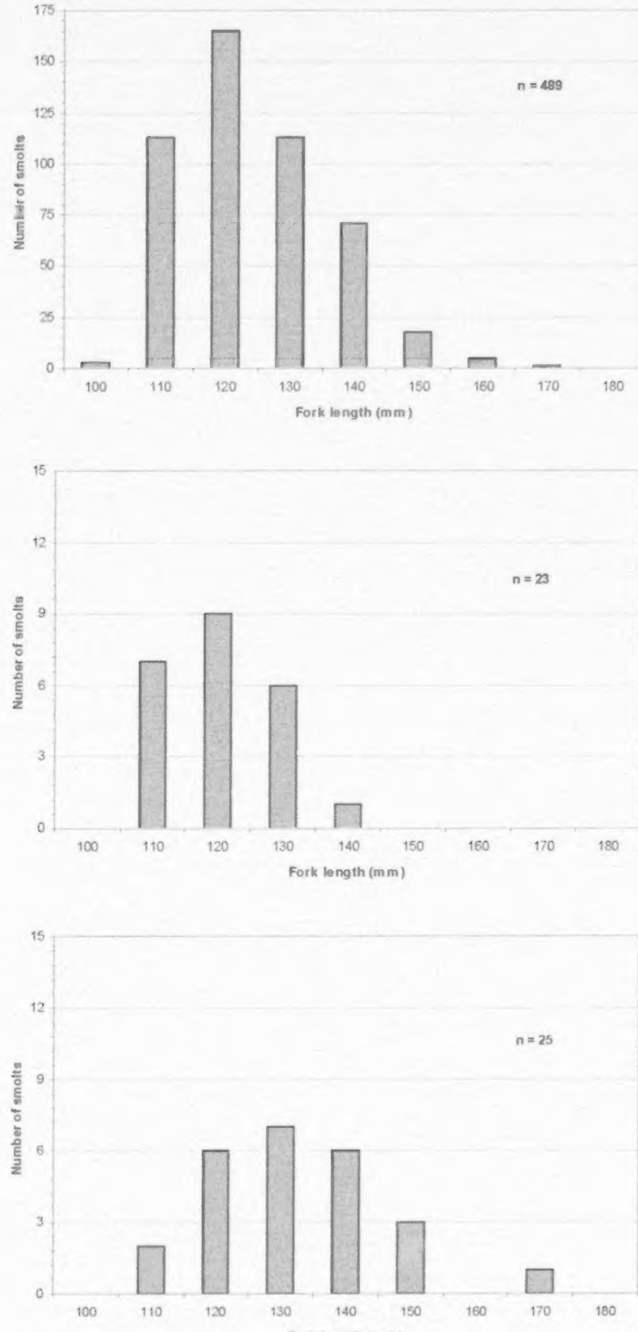


Figure 5. Fork length (mm) distribution of wild smolts sampled at the Northwest Miramichi River rotary screw trap in 2011. Upper panel represents all smolts sampled, the middle and bottom panels depict distributions of age 2 and age 3 smolts, respectively.

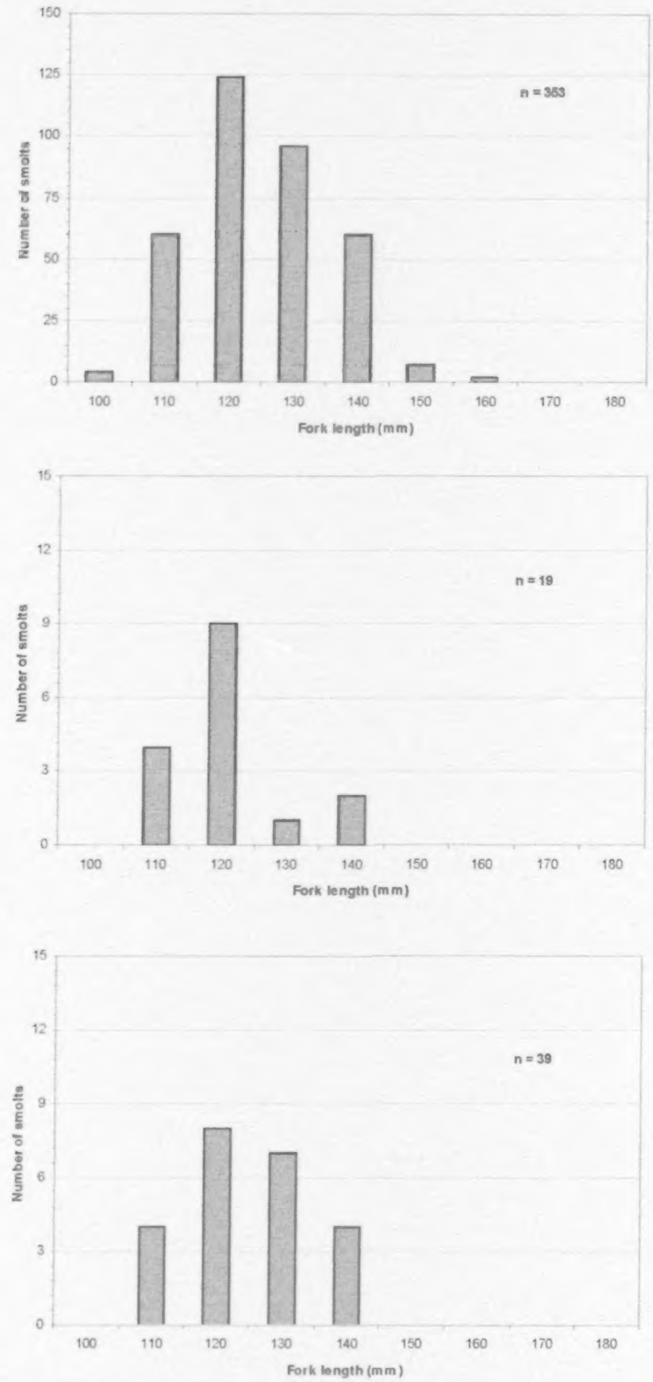


Figure 6. Fork length (mm) distribution of wild smolts sampled at the Big Sevogle River rotary screw trap in 2011. Upper panel represents all smolts sampled, the middle and bottom panels depict distributions of age 2 and age 3 smolts, respectively.

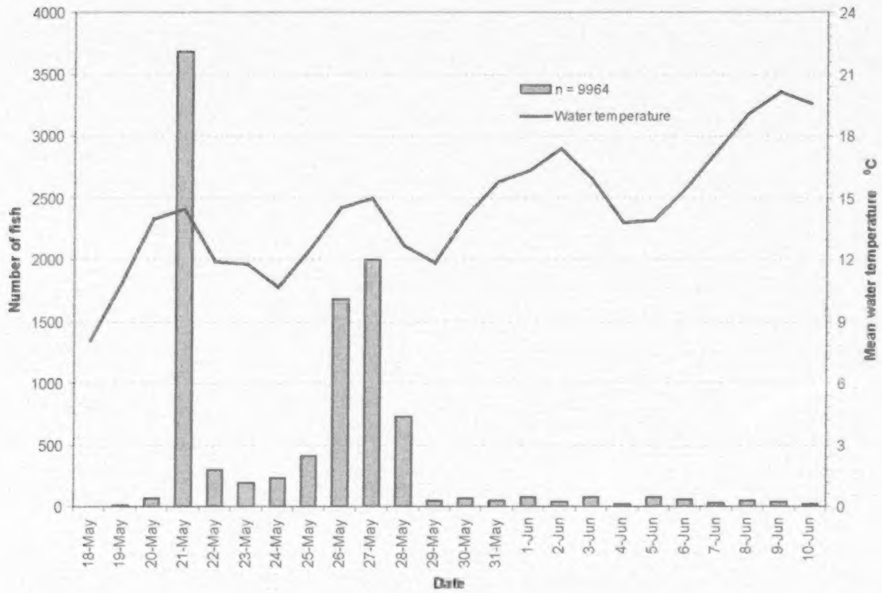


Figure 7. Run timing of smolts from the Northwest Miramichi River system at the Cassilis trapnet relative to the daily mean water temperature in 2011.

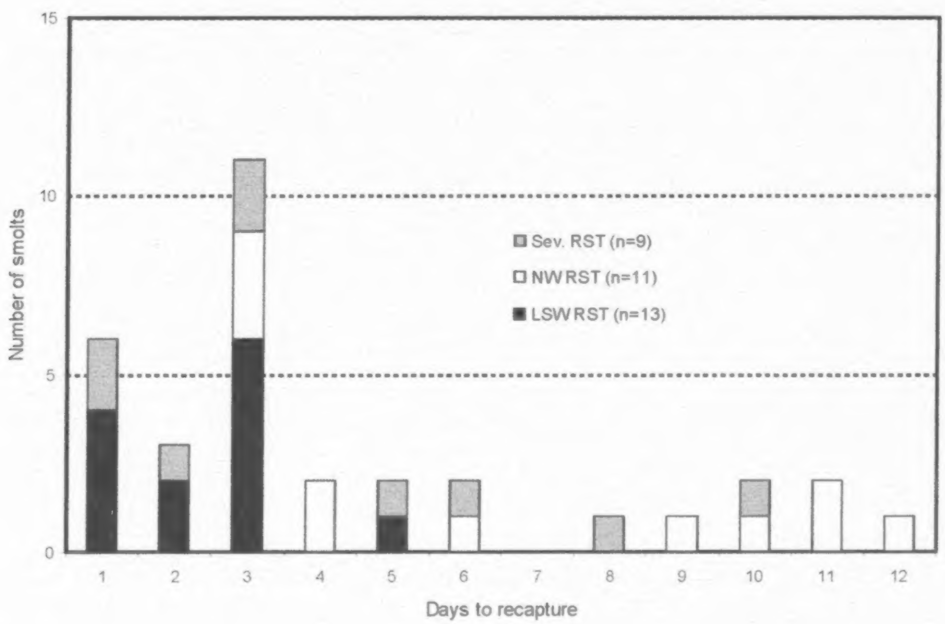


Figure 8. Distribution of time (days) elapsed between the smolt tagging and release event at each of the three rotary screw traps and their subsequent recapture in the trapnet at Cassilis in the Northwest Miramichi estuary in 2011.

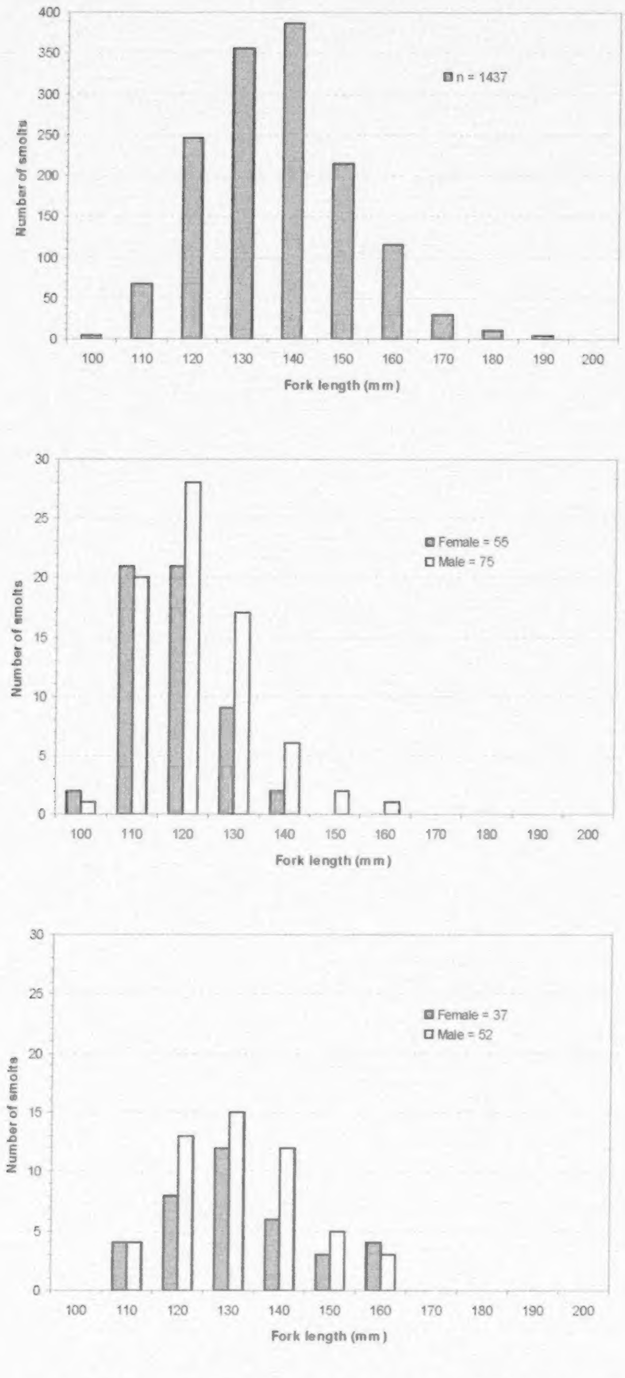


Figure 9. Fork length (mm) distribution of wild smolts sampled at the Cassilis trapnet in 2011. Upper panel represents all smolts sampled, the middle and bottom panels depict distributions of age 2 and age 3 smolts, by sex, respectively.

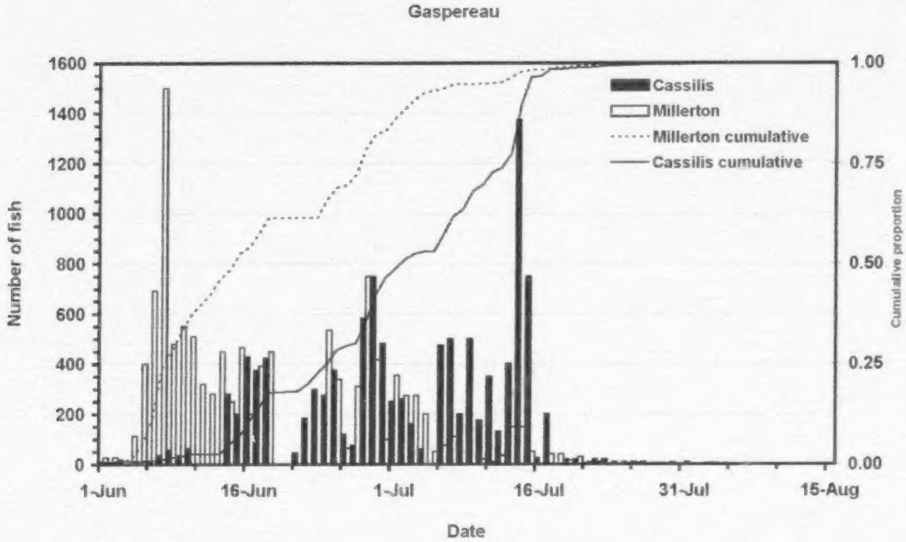


Figure 10. Run timing of gaspereau captured in the DFO index trapnets at Cassilis on the Northwest Miramichi River and at Millerton on the Southwest Miramichi River, June 1 – Aug. 15, 2011.

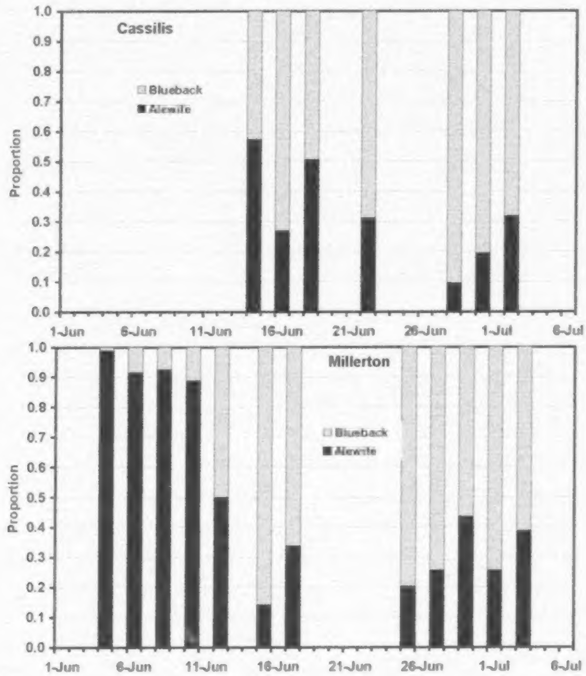
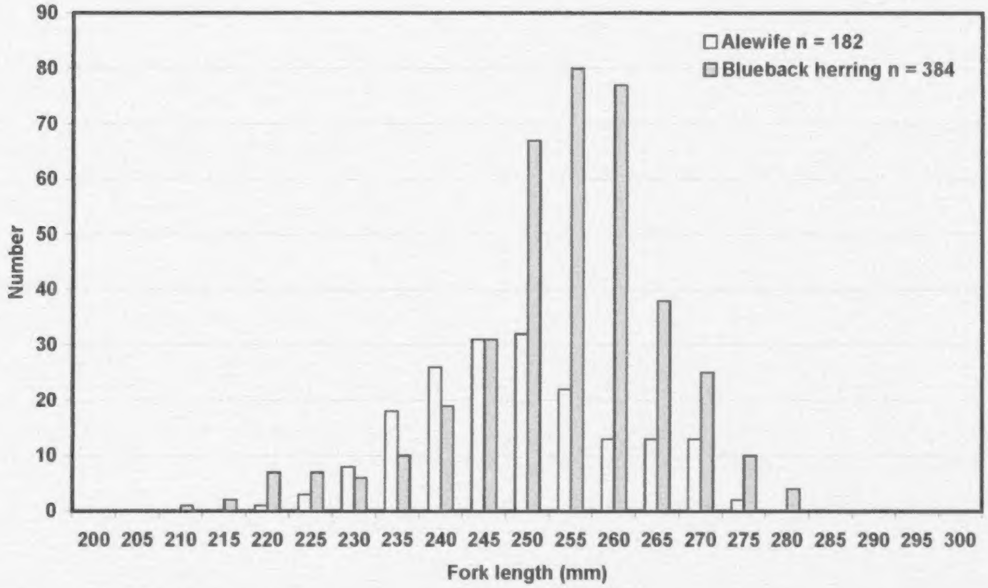


Figure 11. Proportion alewife and blueback herring captured in the DFO index trapnets at Cassilis on the Northwest Miramichi River (upper) and at Millerton on the Southwest Miramichi River (lower) in 2011.



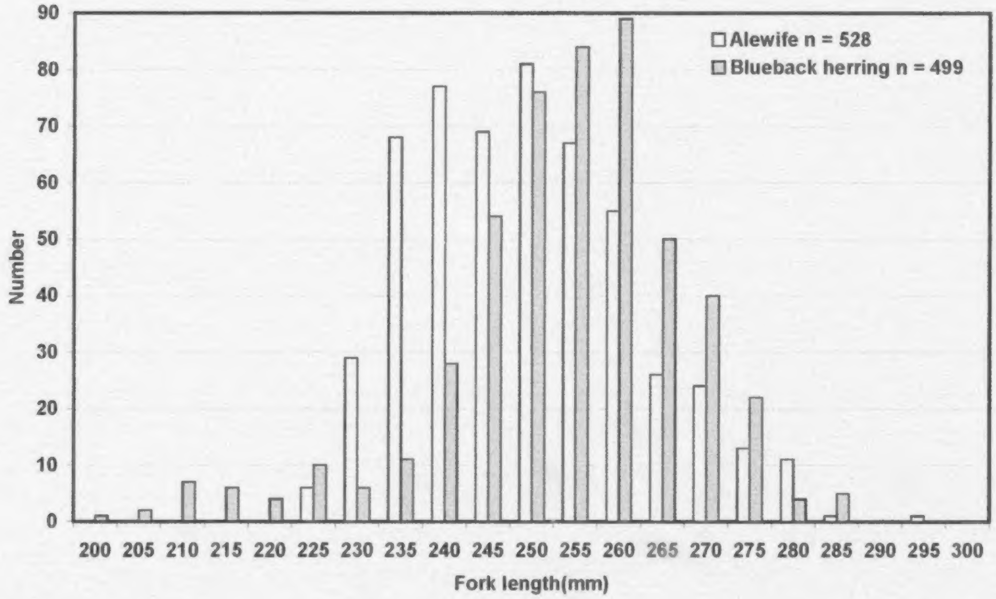
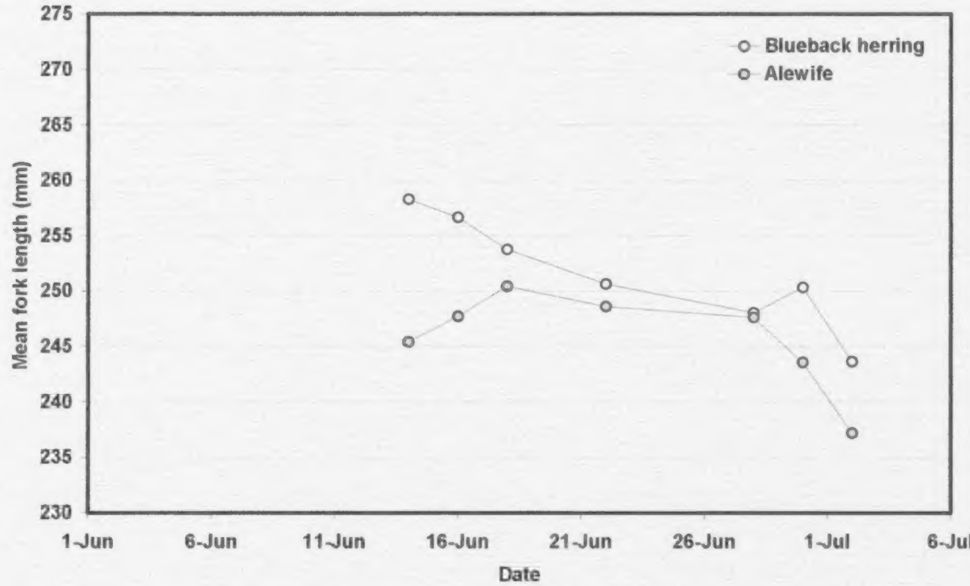


Figure 12. Fork length distribution of alewives and blueback herring captured in the Cassilis (upper) and Millerton (lower) trapnets in 2011.



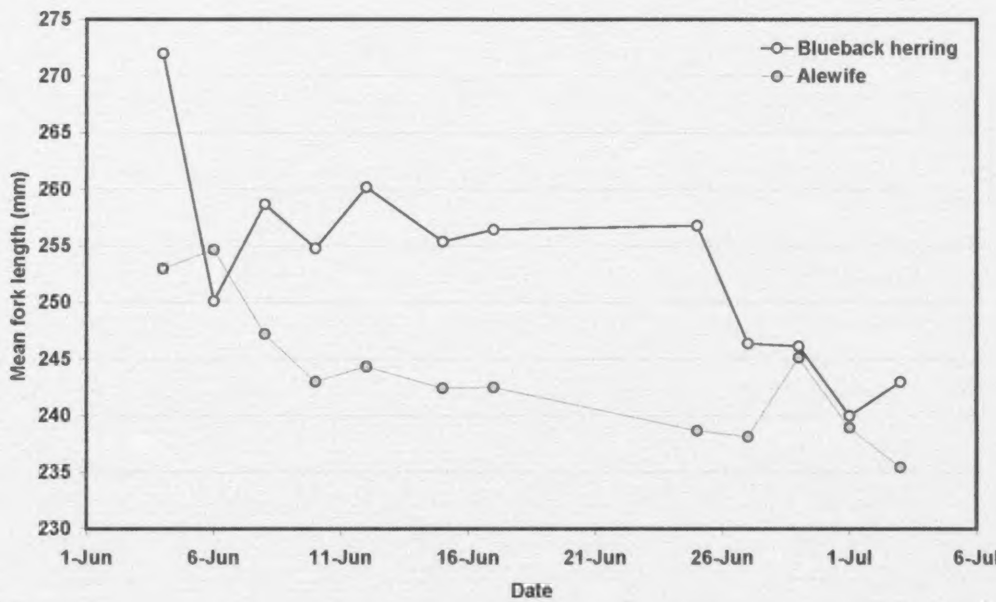


Figure 13. Mean fork length of alewives and blueback herring over the course of their spawning run to the Northwest (Cassilis, upper) and Southwest (Millerton, lower) Miramichi rivers in 2011.

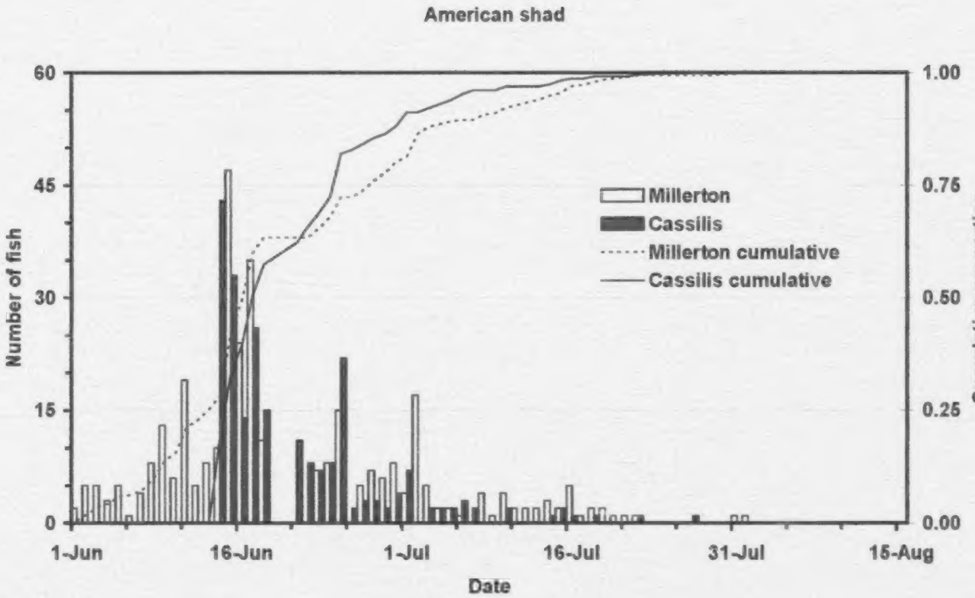


Figure 14. Run timing of American shad captured in the DFO index trapnets at Millerton on the Southwest Miramichi River and at Cassilis on the Northwest Miramichi River, June 1 – Aug. 15, 2011.

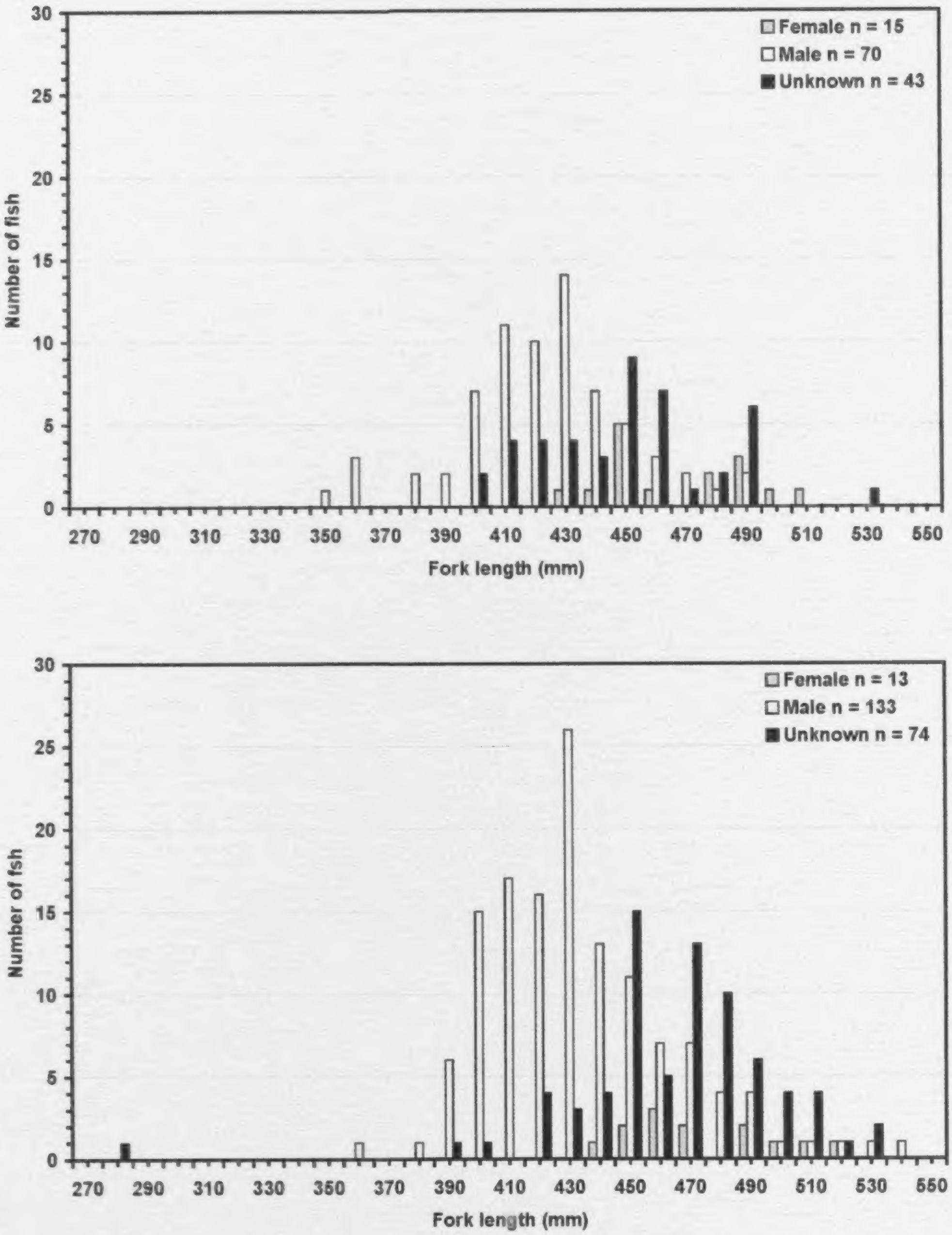


Figure 15. Fork length distribution of American shad captured in the Cassilis (upper) and Millerton (lower) trapnet in 2011.

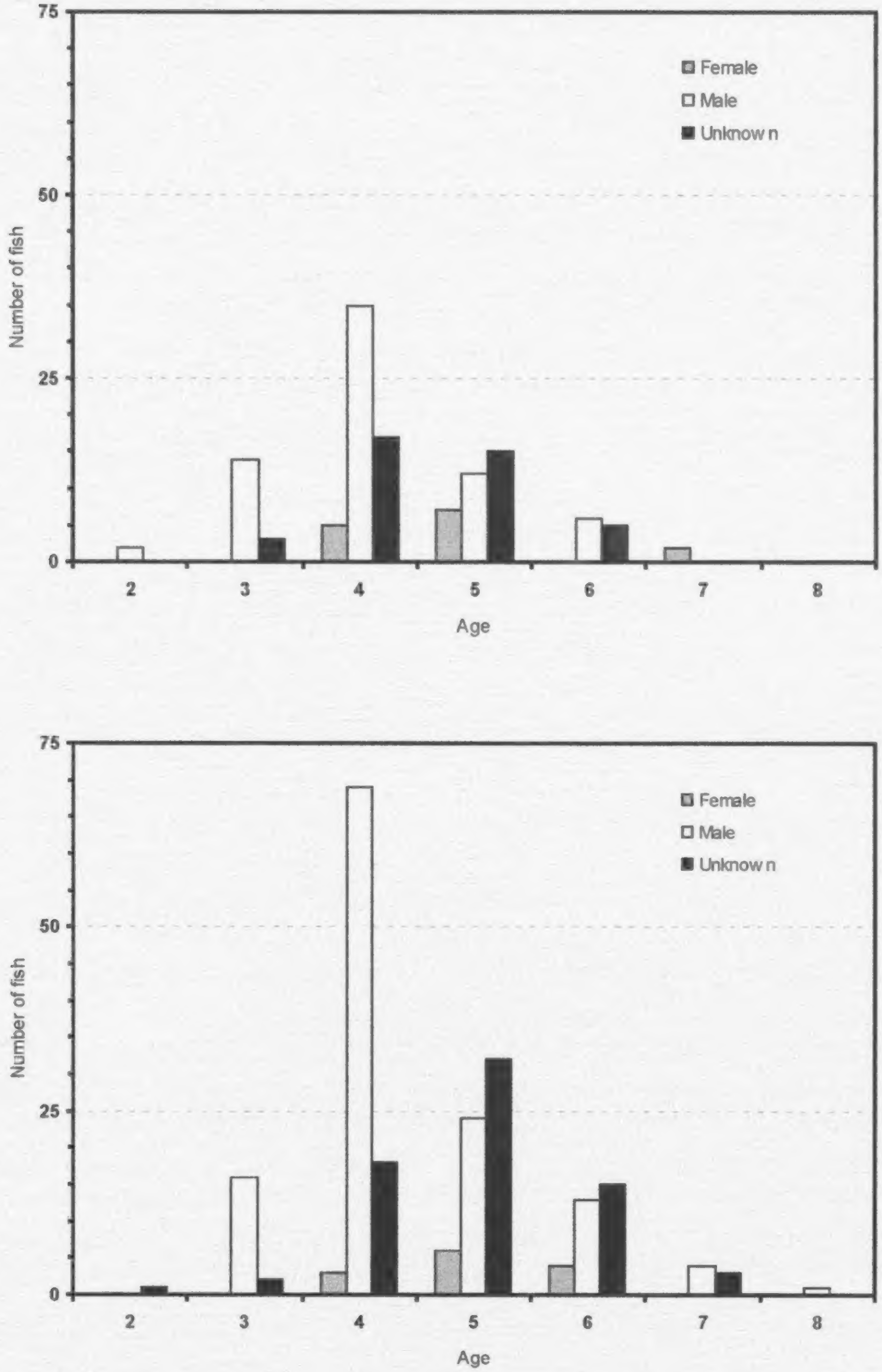


Figure 16. Age distribution of American shad captured in the Cassilis (upper) and Millerton (lower) trapnet in 2011.

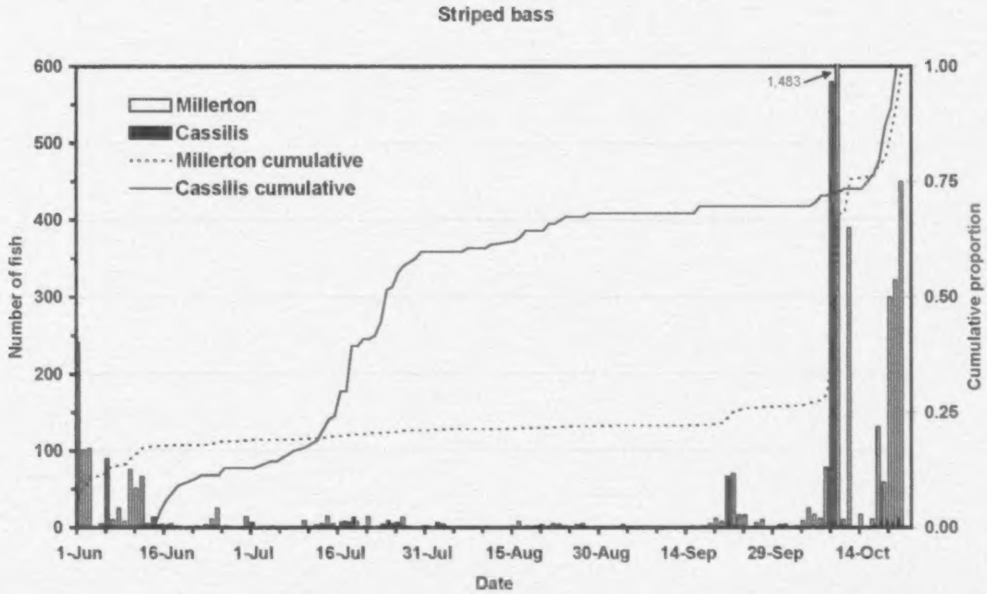


Figure 17. Run timing of striped bass captured in the DFO index trapnets at Millerton on the Southwest Miramichi River and at Cassilis on the Northwest Miramichi River in 2011.

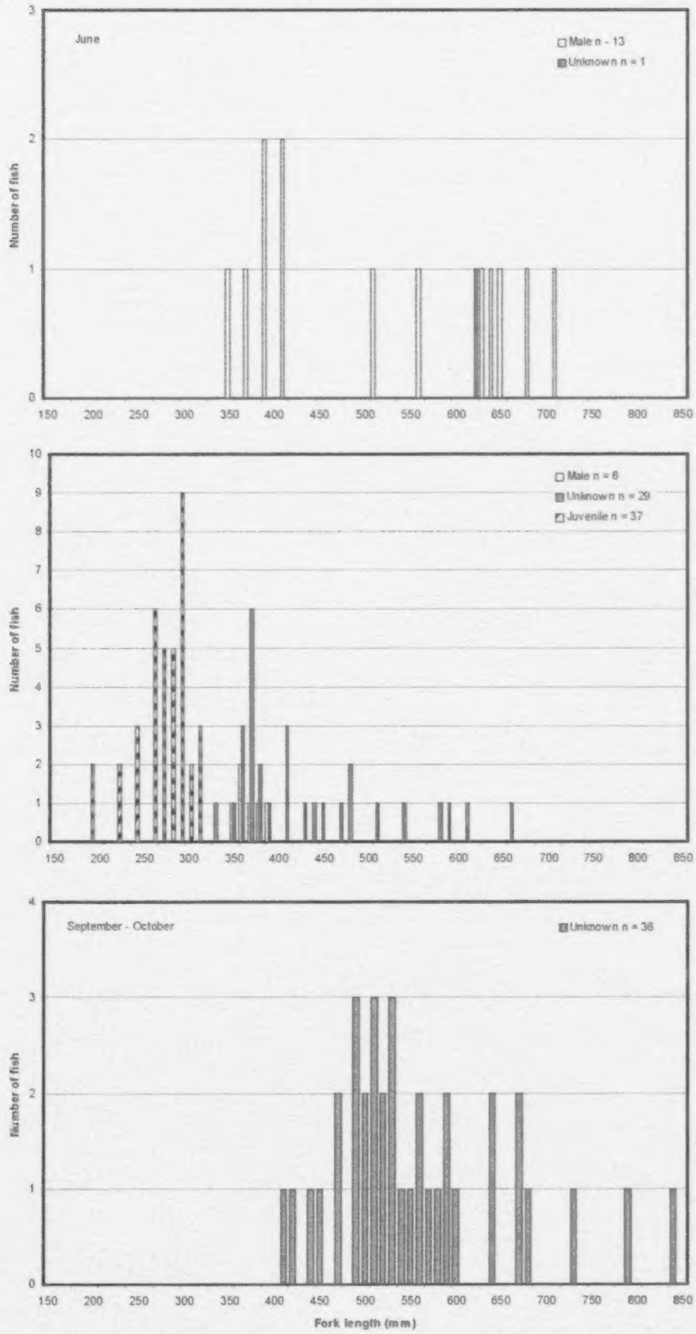


Figure 18. Distributions of fork length recorded from striped bass sampled at the Cassilis trapnet during spring (upper), summer (middle), and fall (lower) in 2011. "Unknown" refers to striped bass without a positive sex identification. Striped bass without a positive sex identification with a fork length ≤ 320 mm were considered to be juvenile.

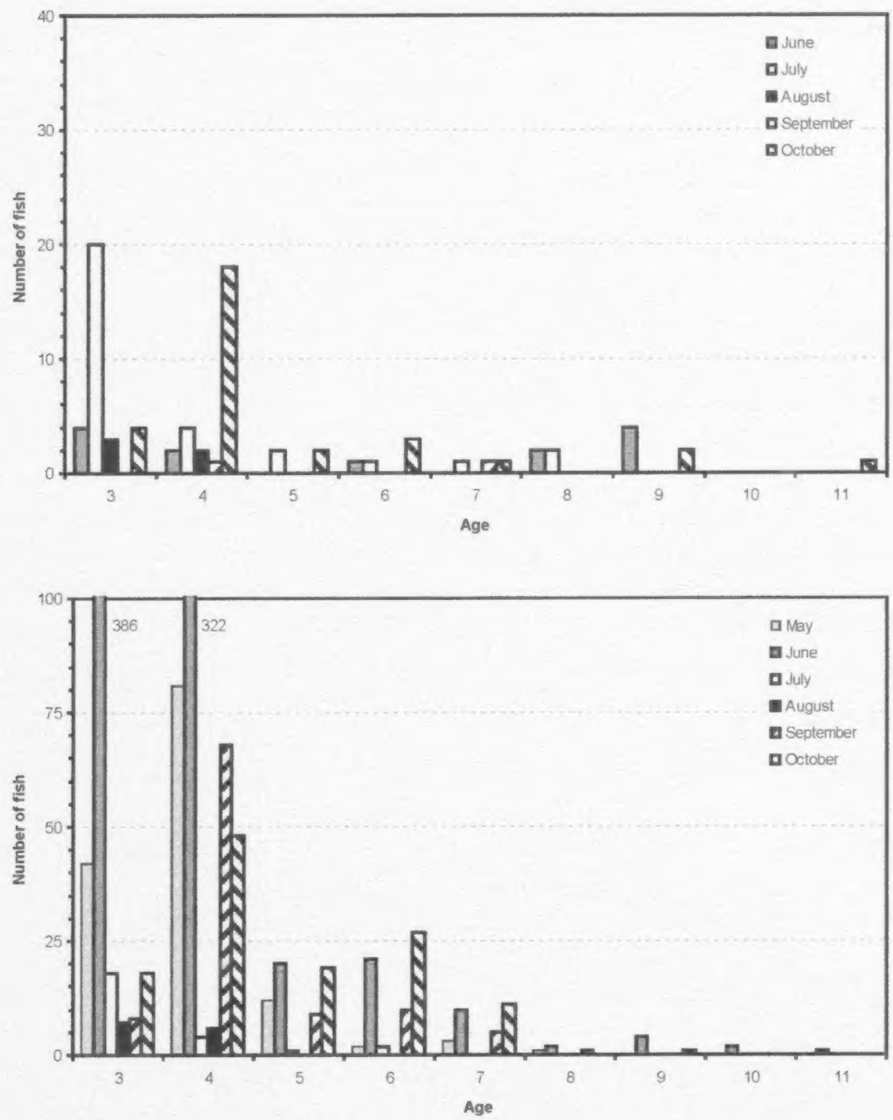


Figure 19. Age distribution of striped bass captured in the Cassilis (upper) and Millerton (lower) trapnets during the 2011 season.

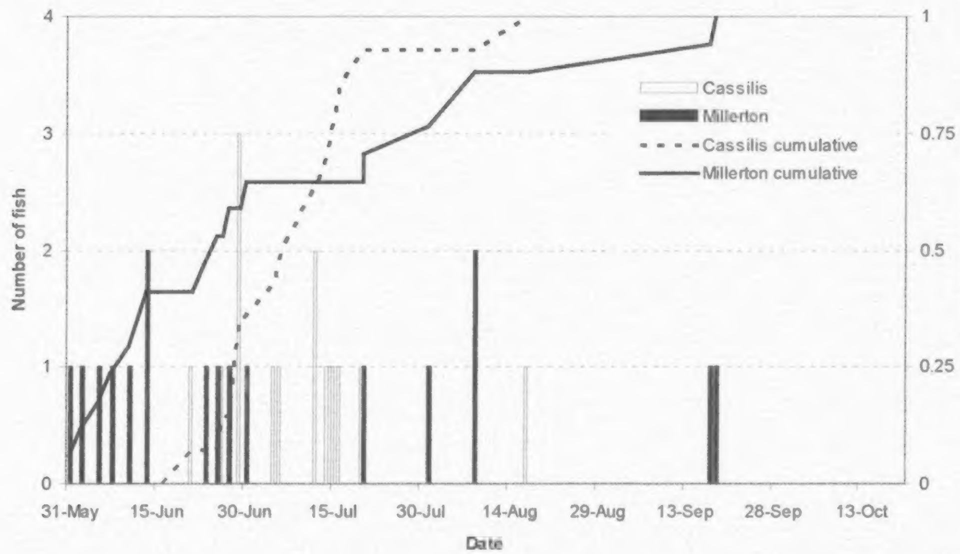


Figure 20. Run timing of American eel captured in the DFO index trapnets at Millerton on the Southwest Miramichi River and at Cassilis on the Northwest Miramichi River in 2011.

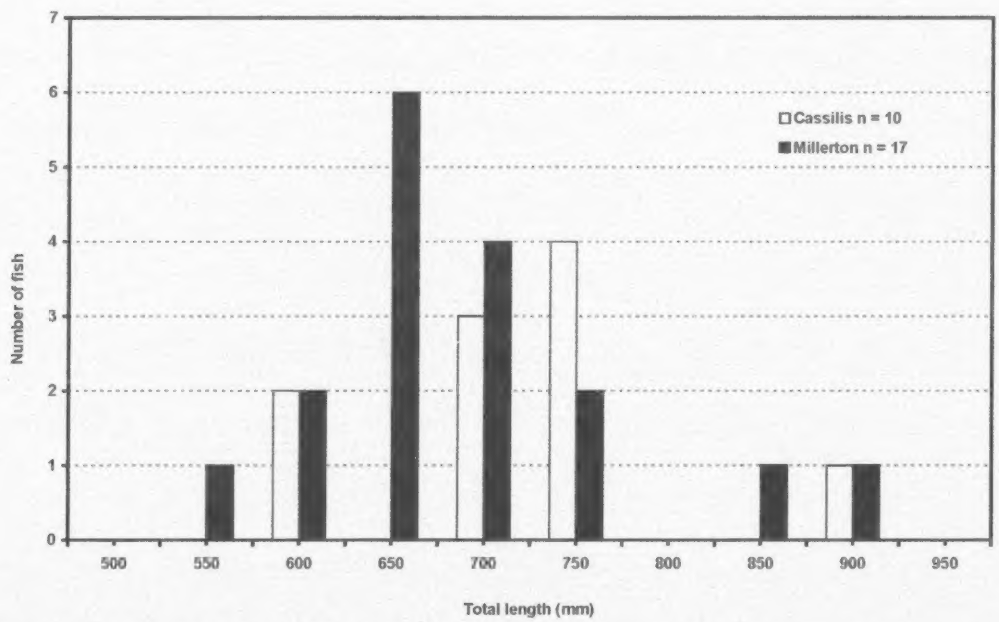


Figure 21. Total length distribution of American eel captured in the DFO index trapnets at Millerton on the Southwest Miramichi River and at Cassilis on the Northwest Miramichi River in 2011.

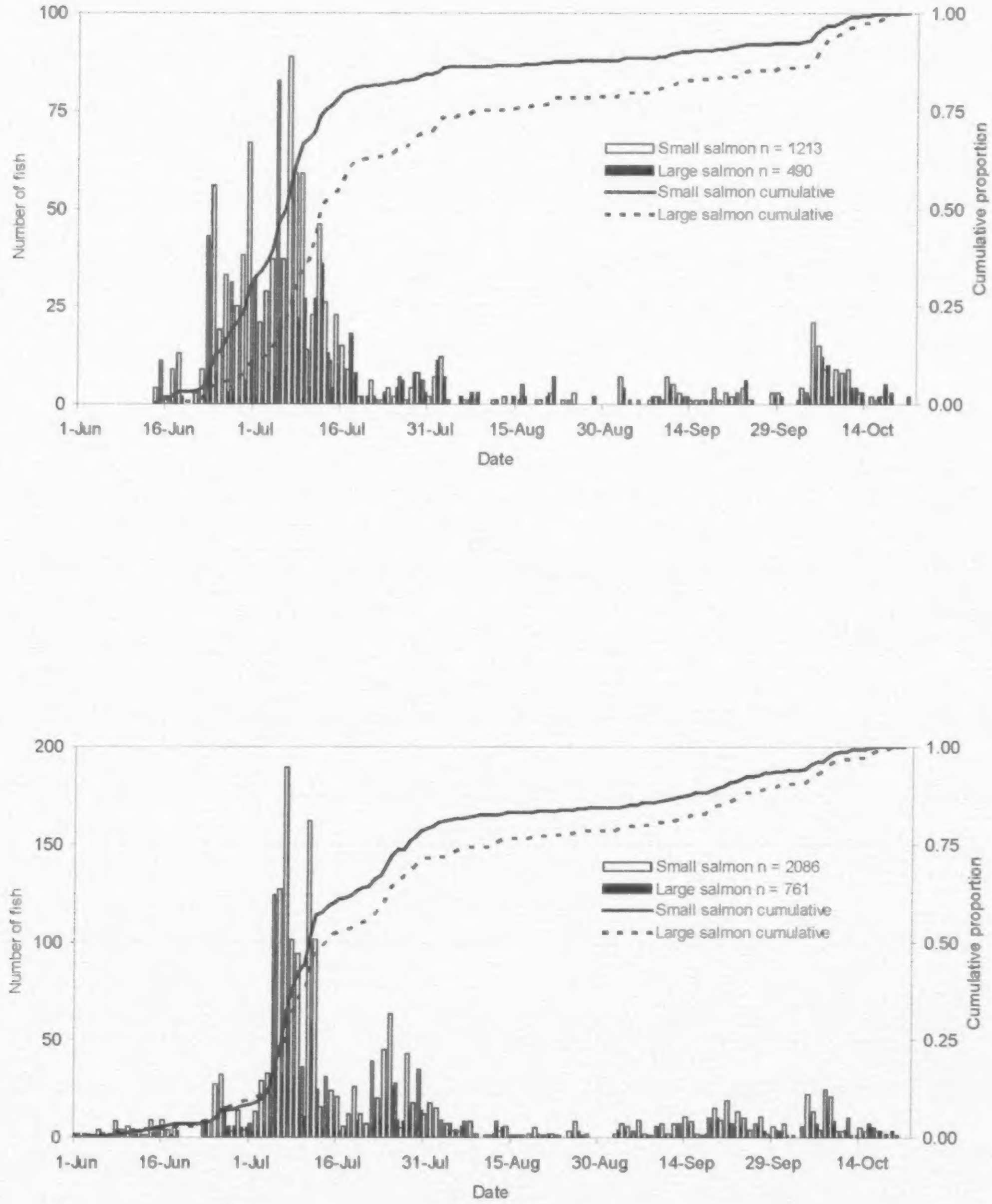
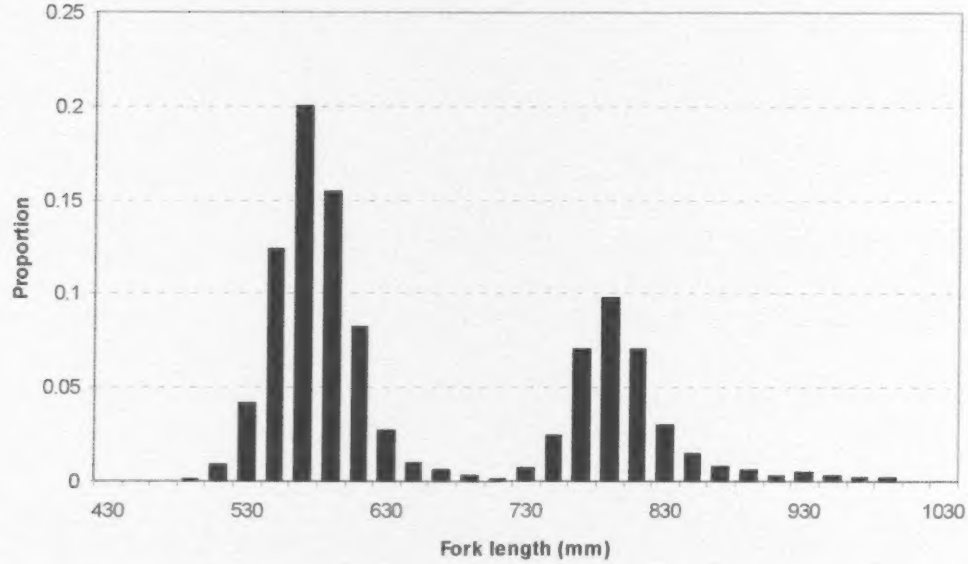


Figure 22. Daily and cumulative catches of Atlantic salmon (small and large) from estuarine trapnets at Cassilis (upper panel) on the Northwest Miramichi and at Millerton (lower panel) on the Southwest Miramichi in 2011.



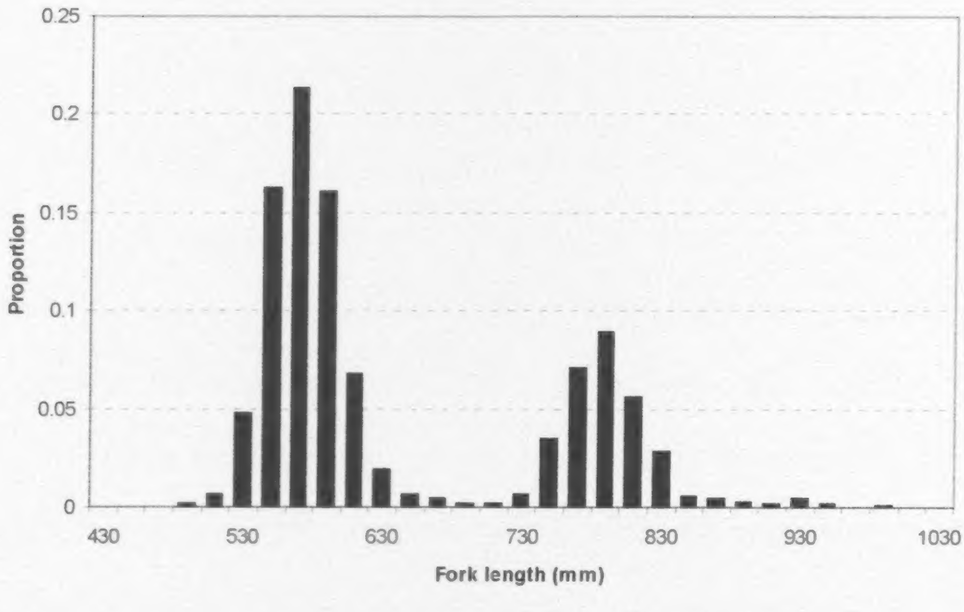


Figure 23. Proportion at length of all salmon sampled at the Cassilis (upper plot) and Millerton (lower plot) estuarine trapnets in 2011.

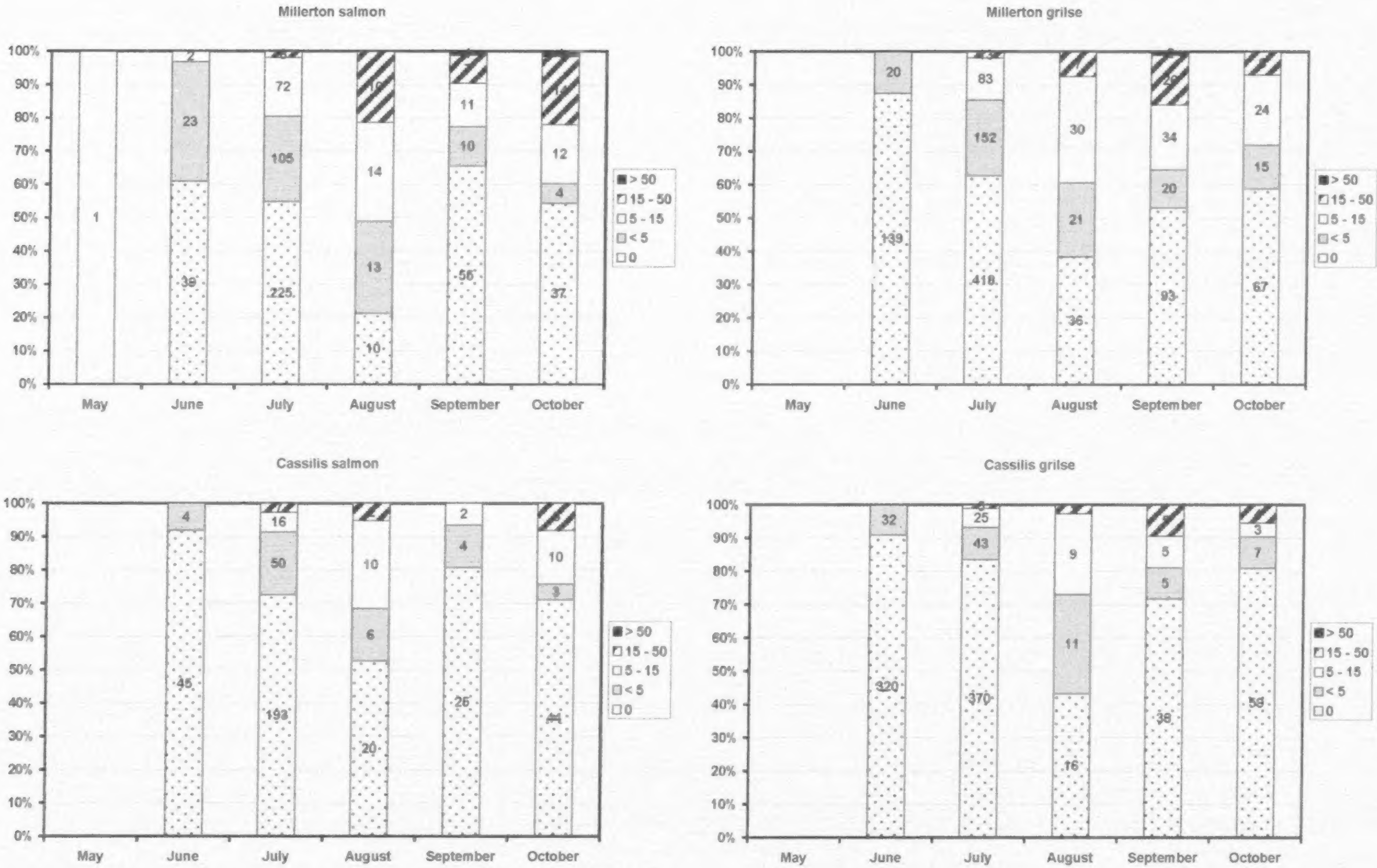


Figure 24. Percent of salmon and grilse captured at the index trapnet at Millerton (upper) and at Cassilis (lower) with varying sea lice loads from 0 to > 50 in 2011. Numbers within the bars are number of fish represented in that category.

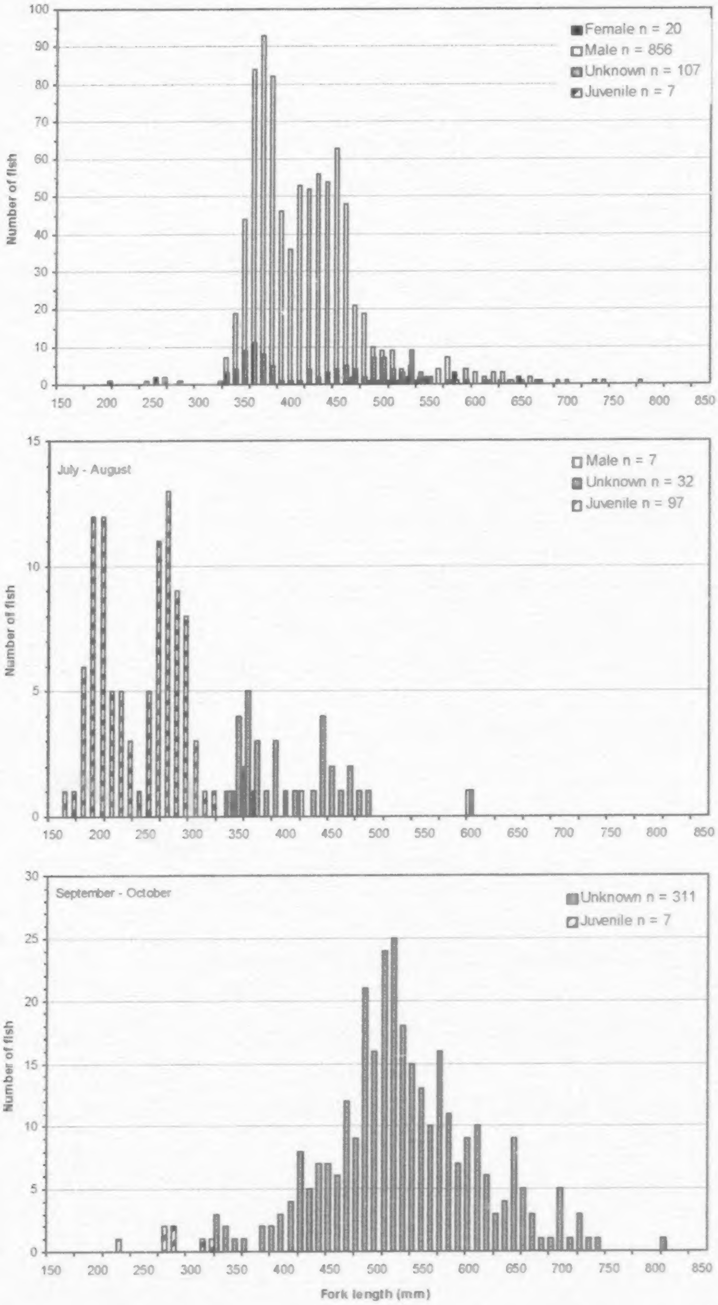
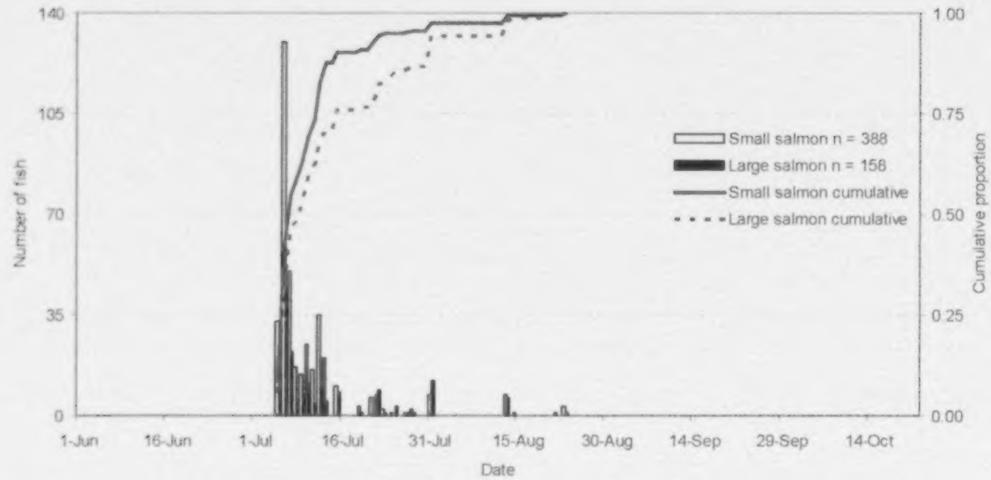


Figure 25. Distributions of fork length recorded from striped bass sampled in the Millerton trapnet during spring (upper), summer (middle), and fall (lower) in 2011. "Unknown' refers to striped bass without a positive sex identification. Striped bass without a positive sex identification with a fork length ≤ 320 mm were considered to be juvenile.



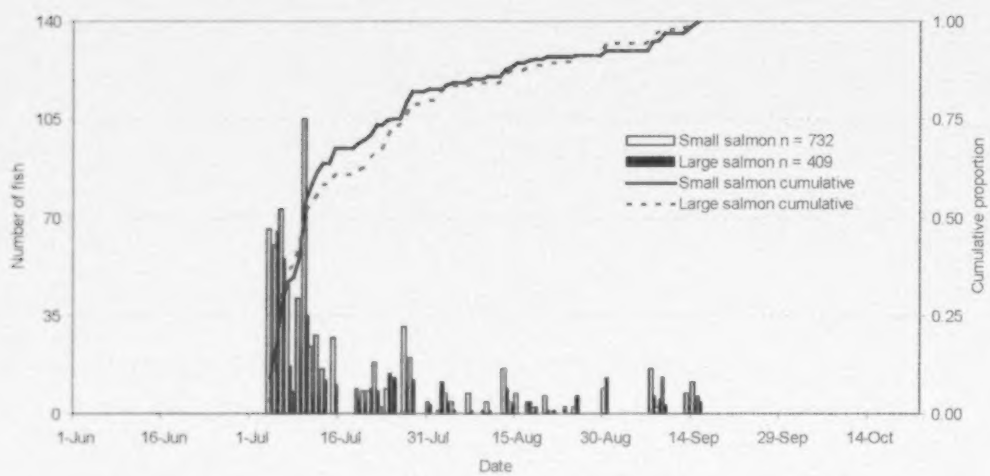
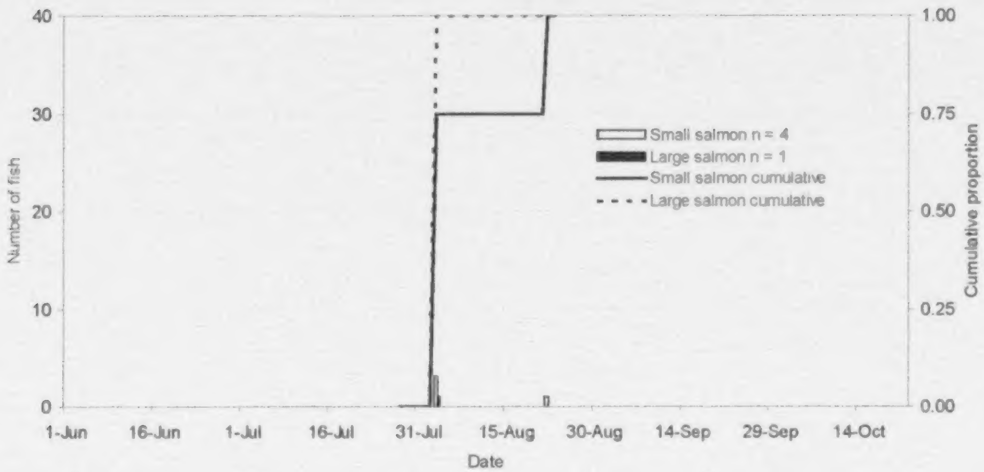


Figure 26. Daily and cumulative catches of small and large Atlantic salmon at trapnets operated by Eel Ground First Nation in the Southwest Miramichi estuary in 2011. The upper plot depicts catches at the Enclosure trapnet while the lower plot depicts catches at the trapnet above the railroad bridge.



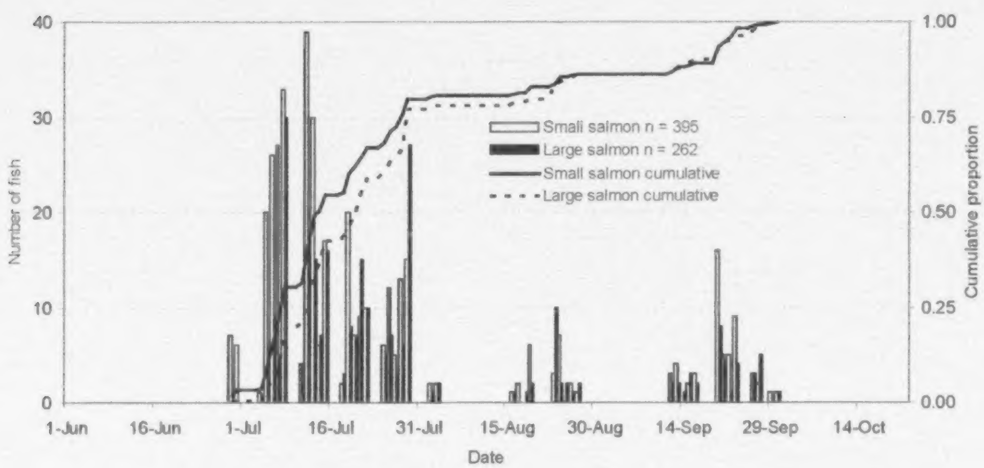


Figure 27. Daily and cumulative catches of Atlantic salmon (small & large) at Red Bank trapnets (Red Bank Northwest – upper, Red Bank Little Southwest – lower) on the Northwest Miramichi in 2011.

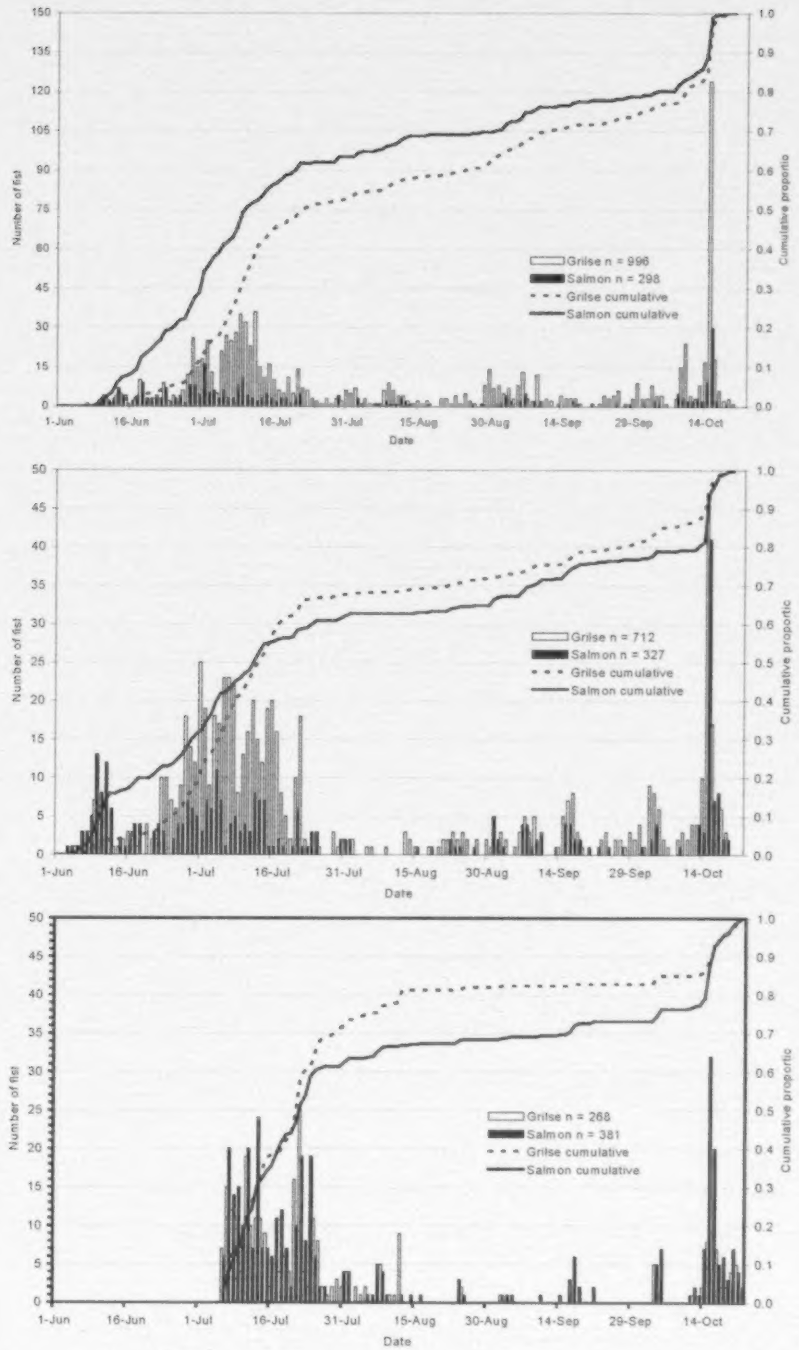


Figure 28. Daily and cumulative counts of Atlantic salmon and grilse to the headwater protection barrier on the Northwest Miramichi River (upper), the Dungarvon River (middle), and the North Branch of the Southwest Miramichi River near Juniper (lower) in 2011.

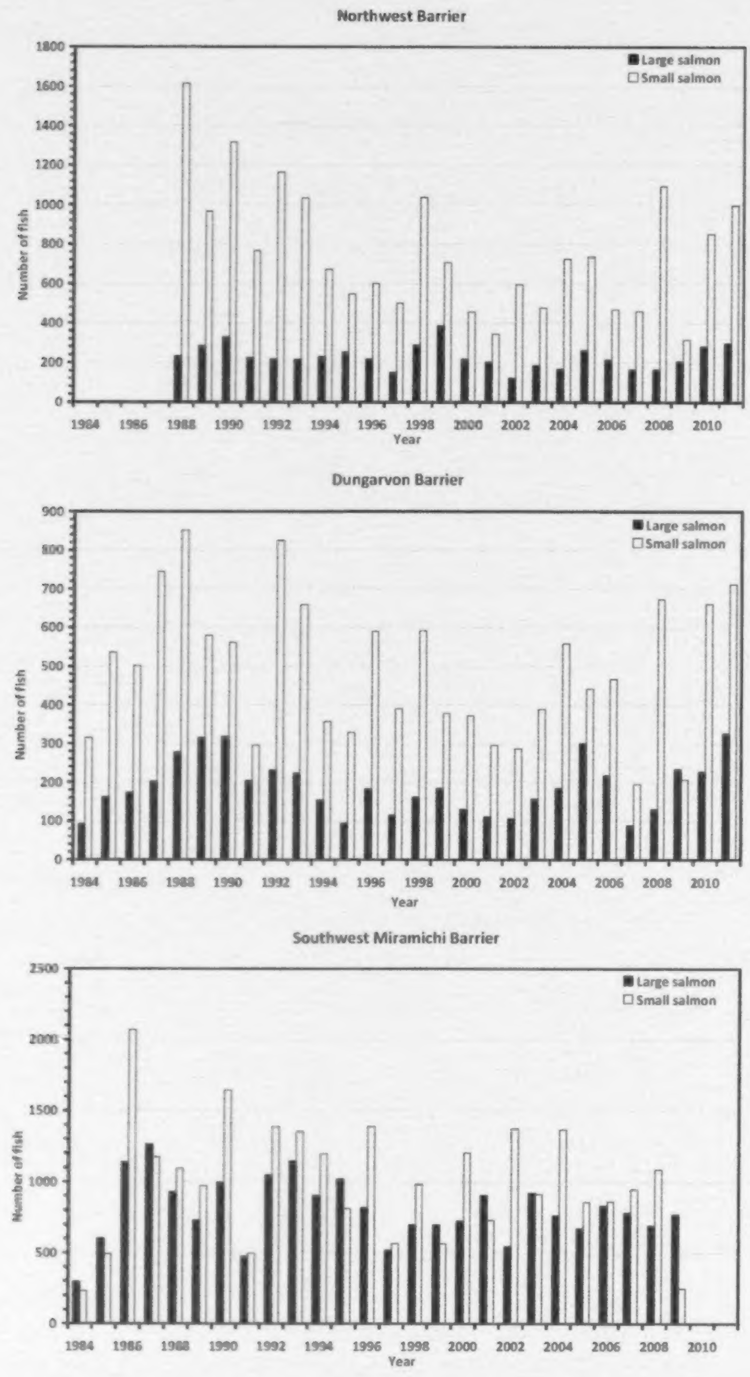


Figure 29. Summary of large (≥63 cm) and small (<63 cm) Atlantic salmon counts at the headwater protection barrier on the Northwest Miramichi River (upper), the Dungarvon River (middle), and the North Branch of the Southwest Miramichi River near Juniper between 1984 and 2011.

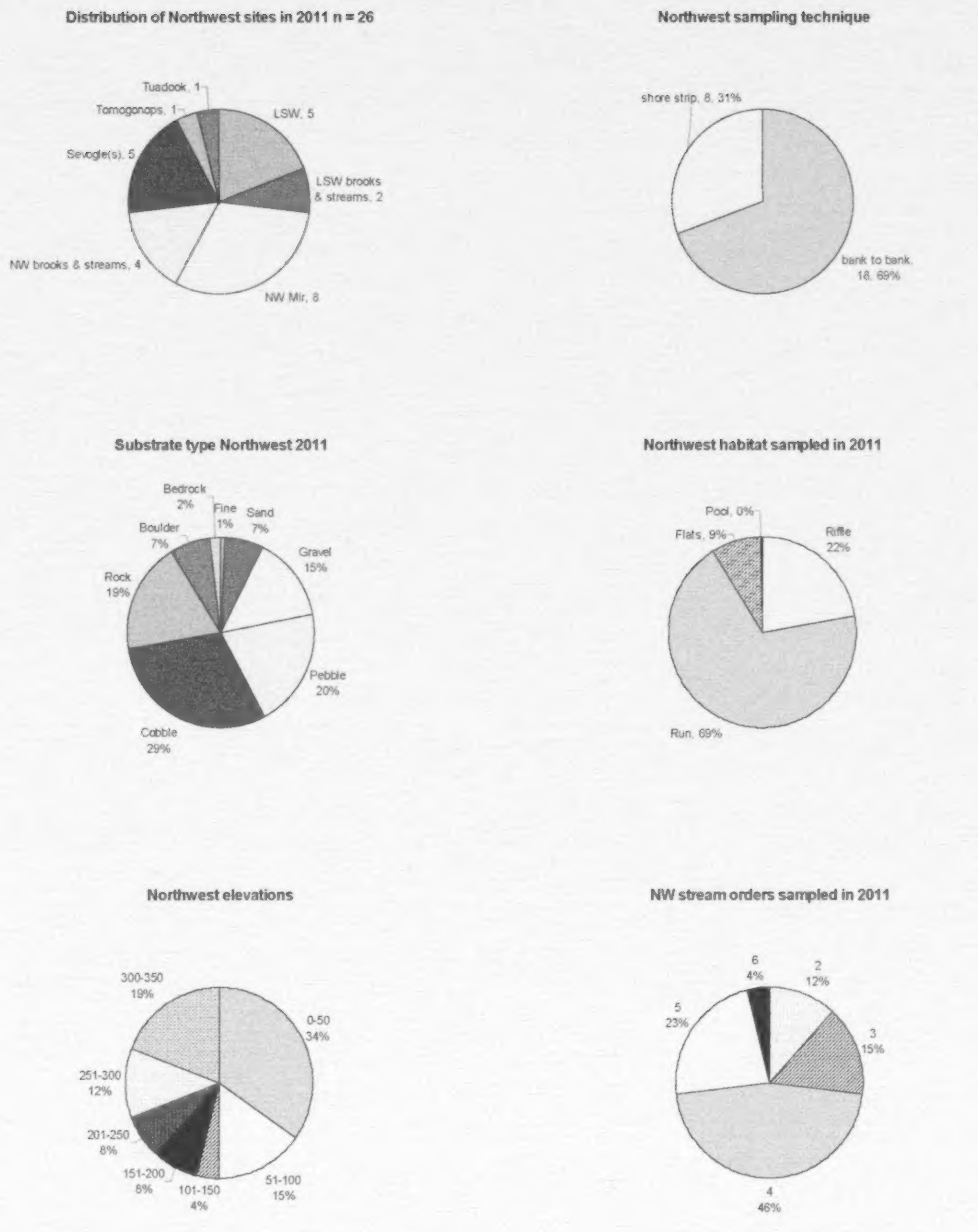


Figure 30. Northwest Miramichi electrofishing survey details including site locations and sampling technique (upper), substrate and habitat type (middle), elevation and stream order (lower) for 2011.

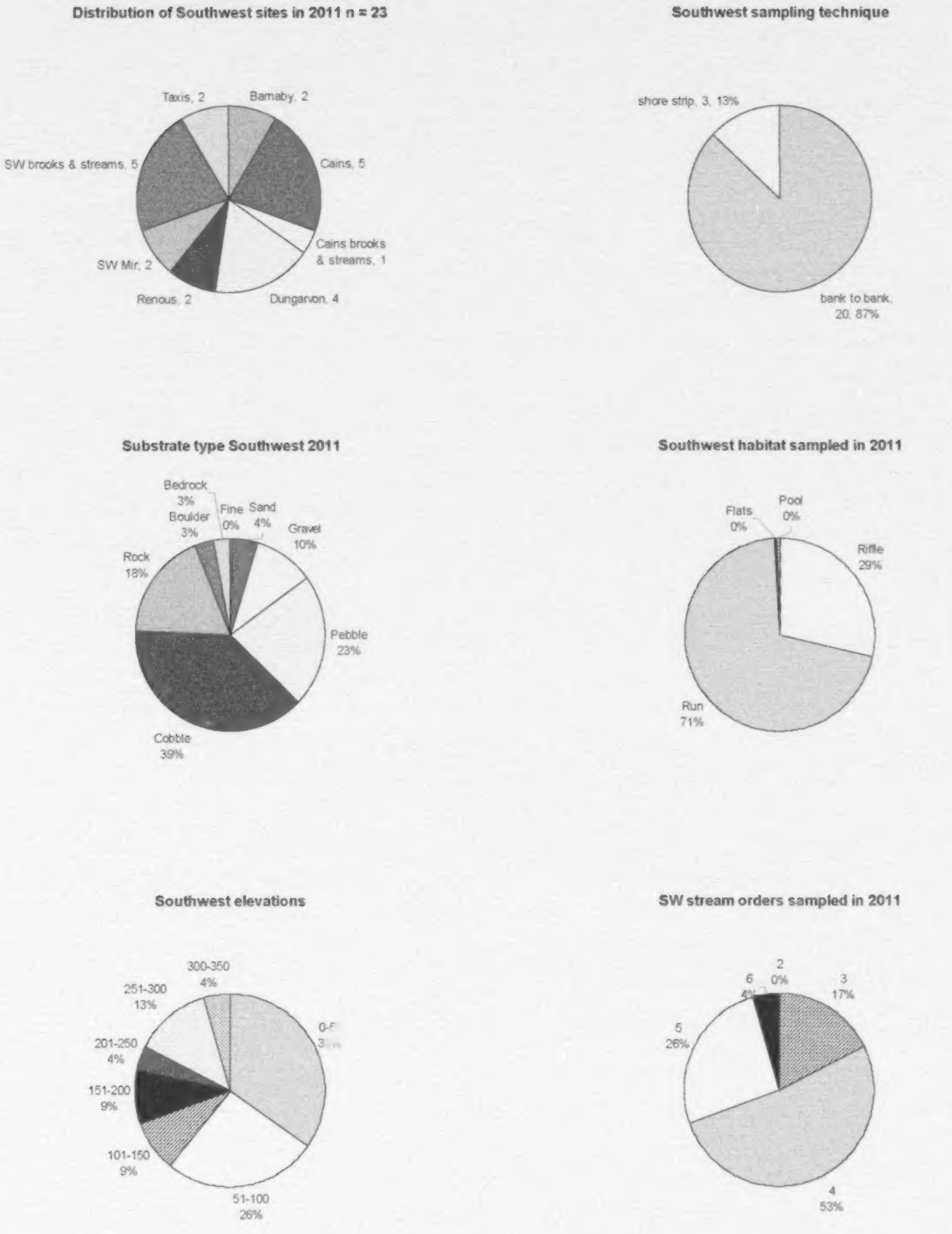


Figure 31. Southwest Miramichi electrofishing survey details including site locations and sampling technique (upper), substrate and habitat type (middle), elevation and stream order (lower) for 2011.

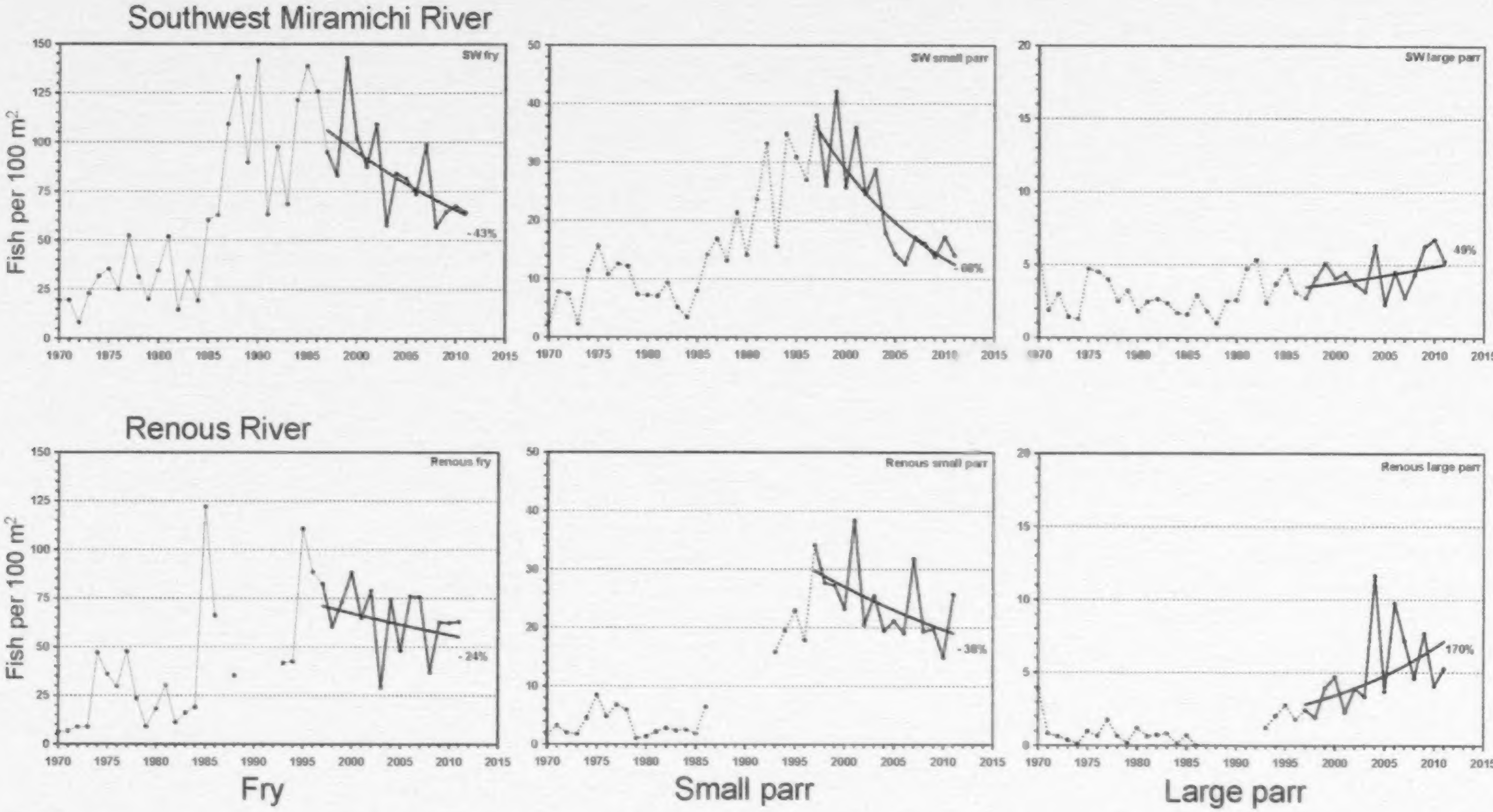


Figure 32. Average abundance of juvenile Atlantic salmon by size in the Southwest Miramichi and Renous rivers, 1970 to 2011. The rate of change as percent increase or decrease over the last 15 years is depicted by the exponential function ($\exp^{Z*15}$-1).

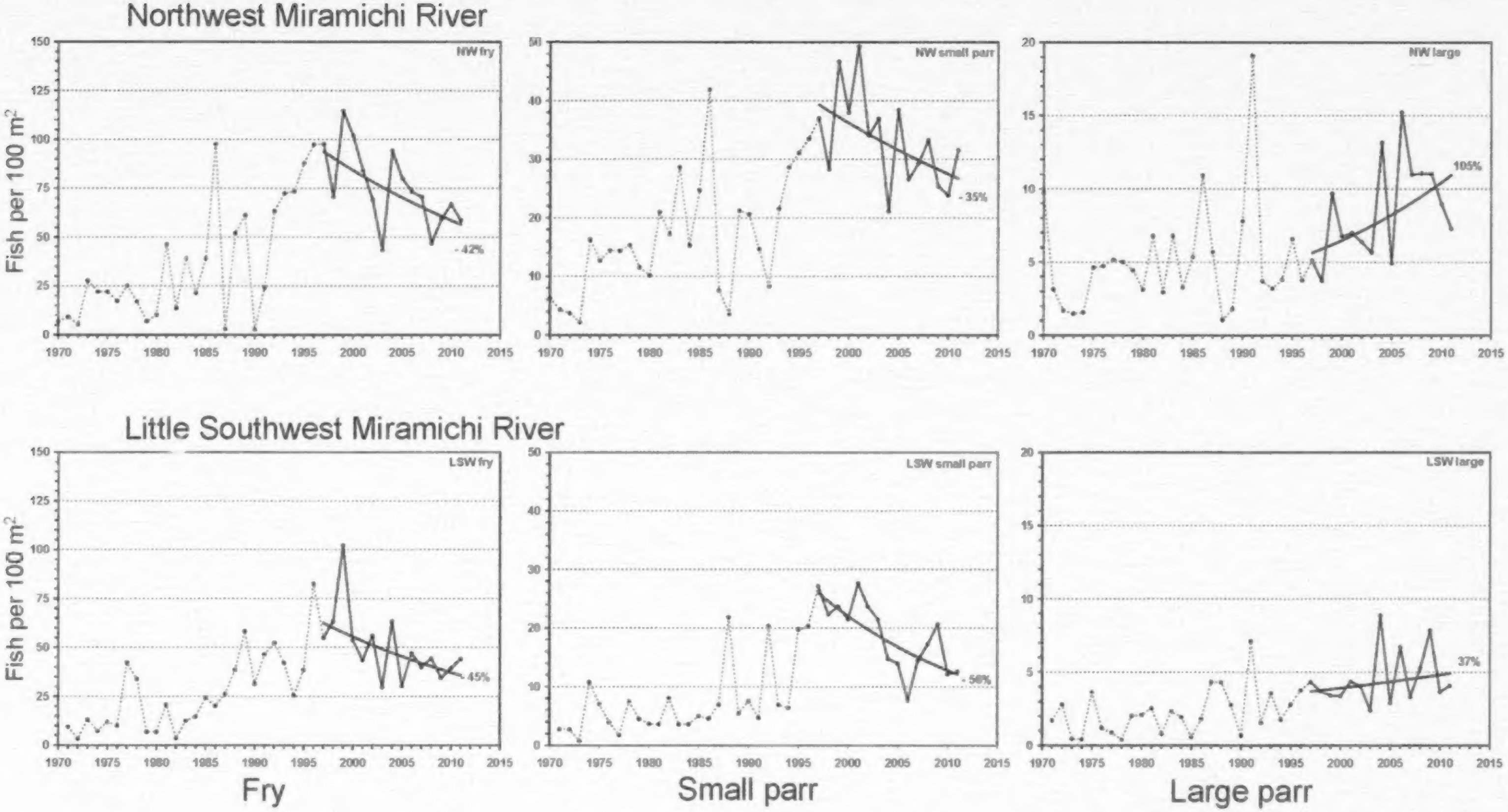


Figure 33. Average abundance of juvenile Atlantic salmon by size in the Northwest Miramichi and Little Southwest Miramichi rivers, 1970 to 2011. The rate of change as percent increase or decrease over the last 15 years is depicted by the exponential function (exp^{Z*15}-1).

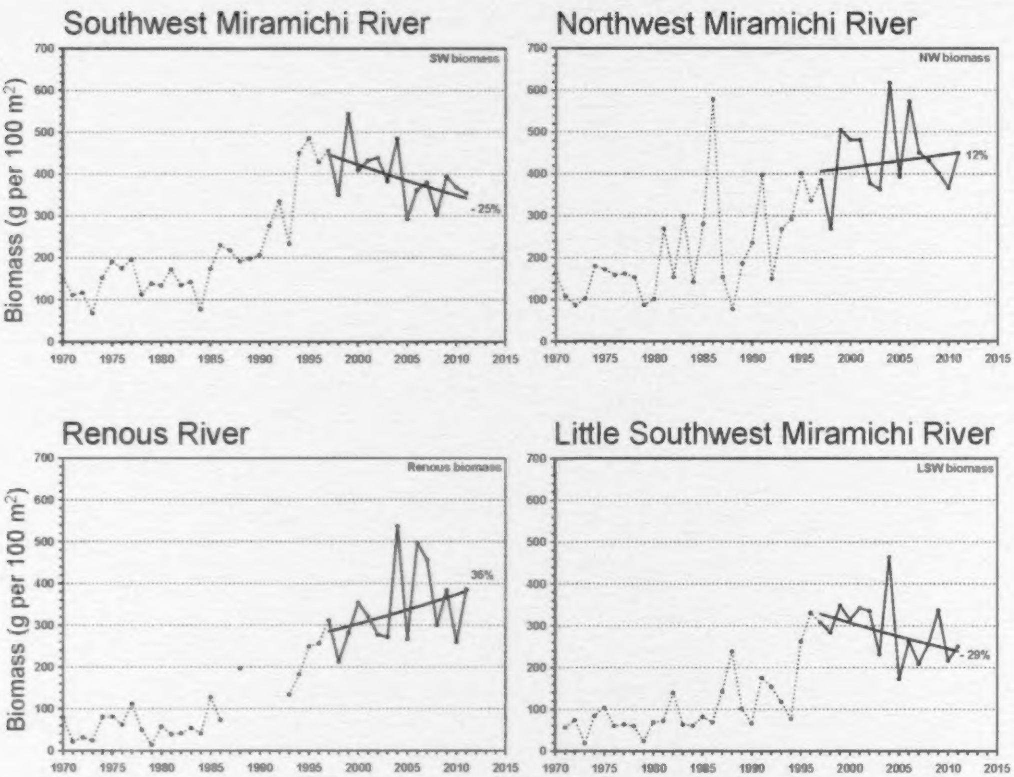


Figure 34. Total biomass of juvenile Atlantic salmon in the four major rivers of the Miramichi watershed, 1970-2011. The rate of change as percent increase or decrease over the last 15 years is depicted by the exponential function (exp^{Z*15}-1).

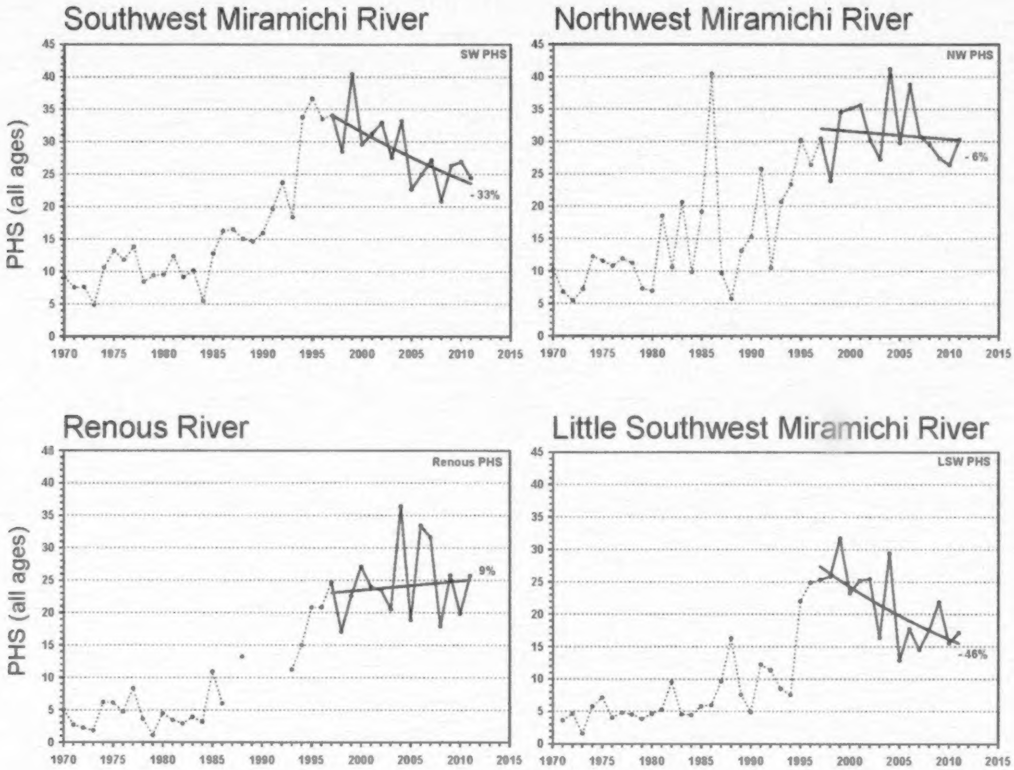


Figure 35. Percent habitat saturation (PHS) for juvenile Atlantic salmon in the four major rivers of the Miramichi watershed, 1970-2011. The rate of change as percent increase or decrease over the last 15 years is depicted by the exponential function ($\exp^{Z*15}$-1).

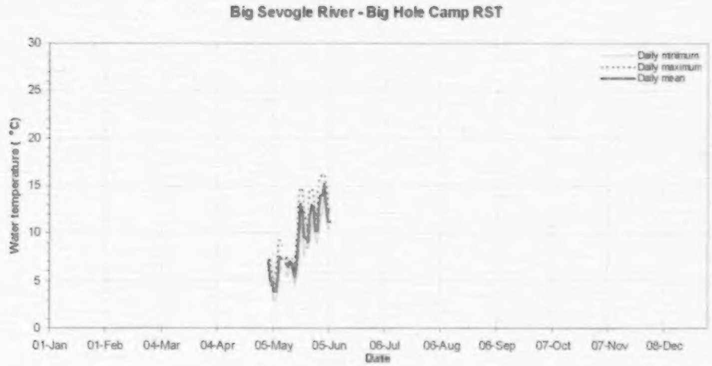


Figure 36. Daily water temperatures (mean, minimum, maximum) from Rotary Screw Trap sites located in the Northwest Miramichi system in 2011.

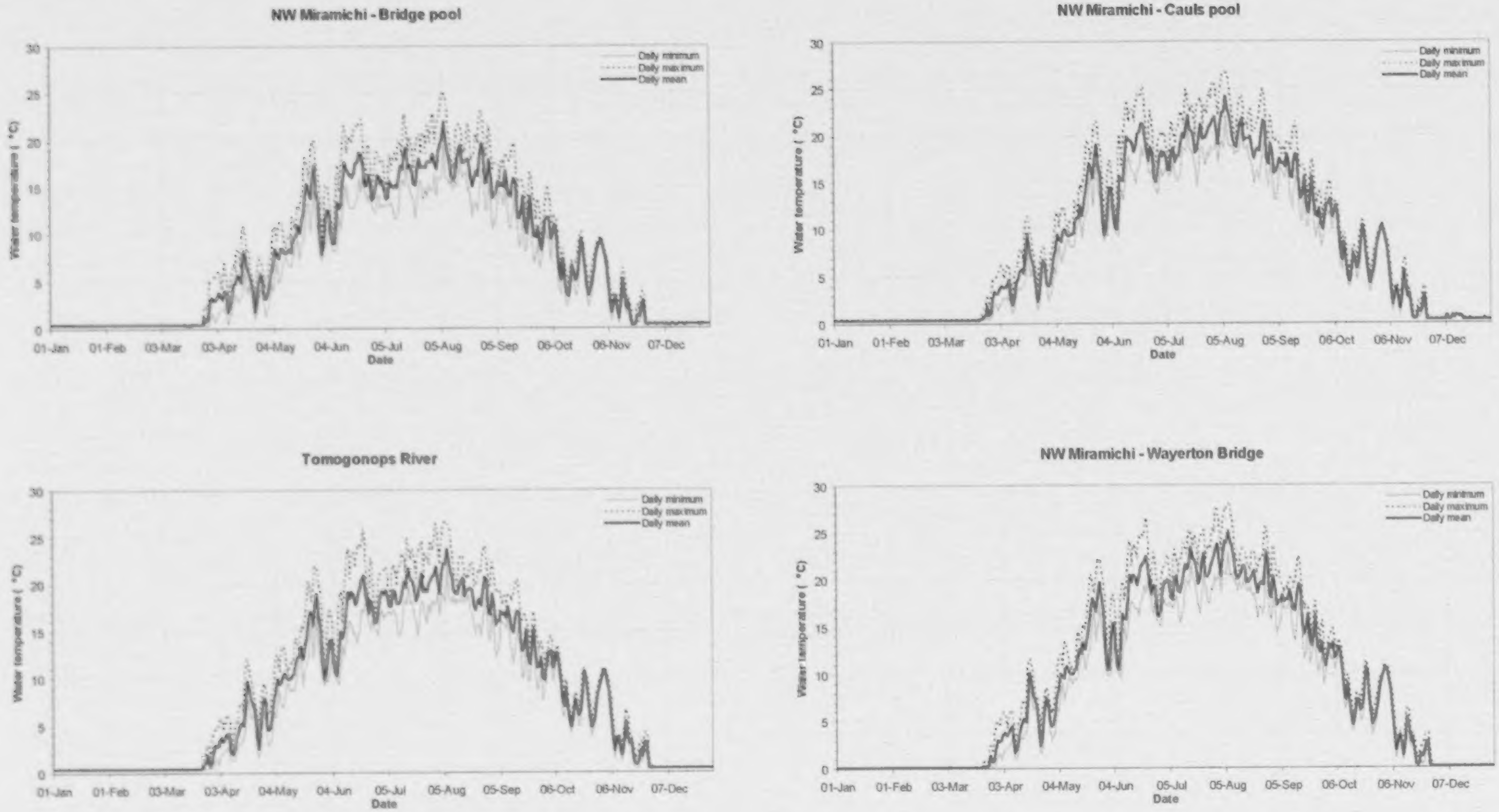


Figure 37. Daily water temperatures (mean, minimum, maximum) from various locations in the Northwest Miramichi watershed in 2011.

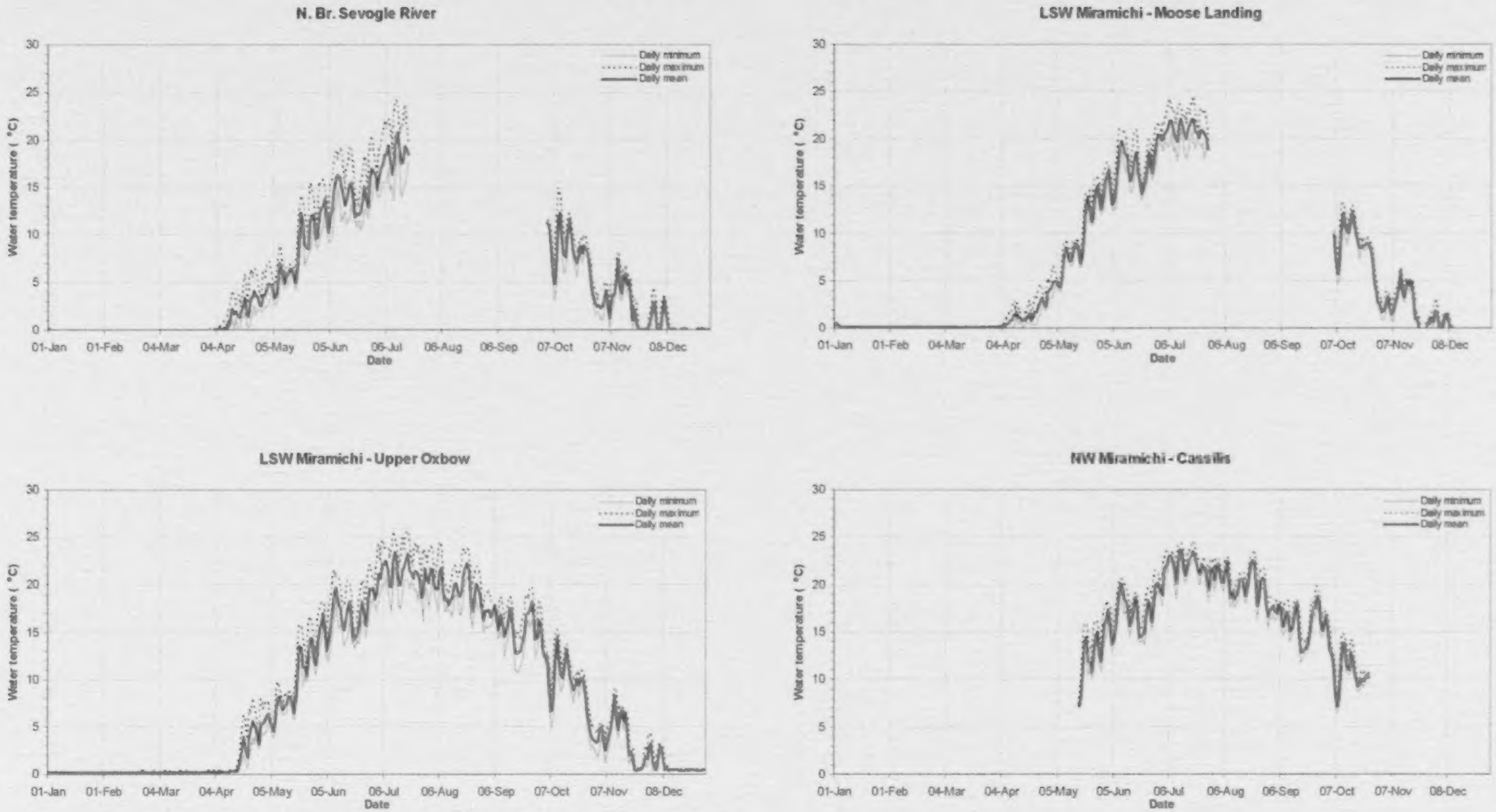


Figure 37. cont'd. Daily water temperatures (mean, minimum, maximum) from various locations in the Northwest (NW) Miramichi watershed in 2011.

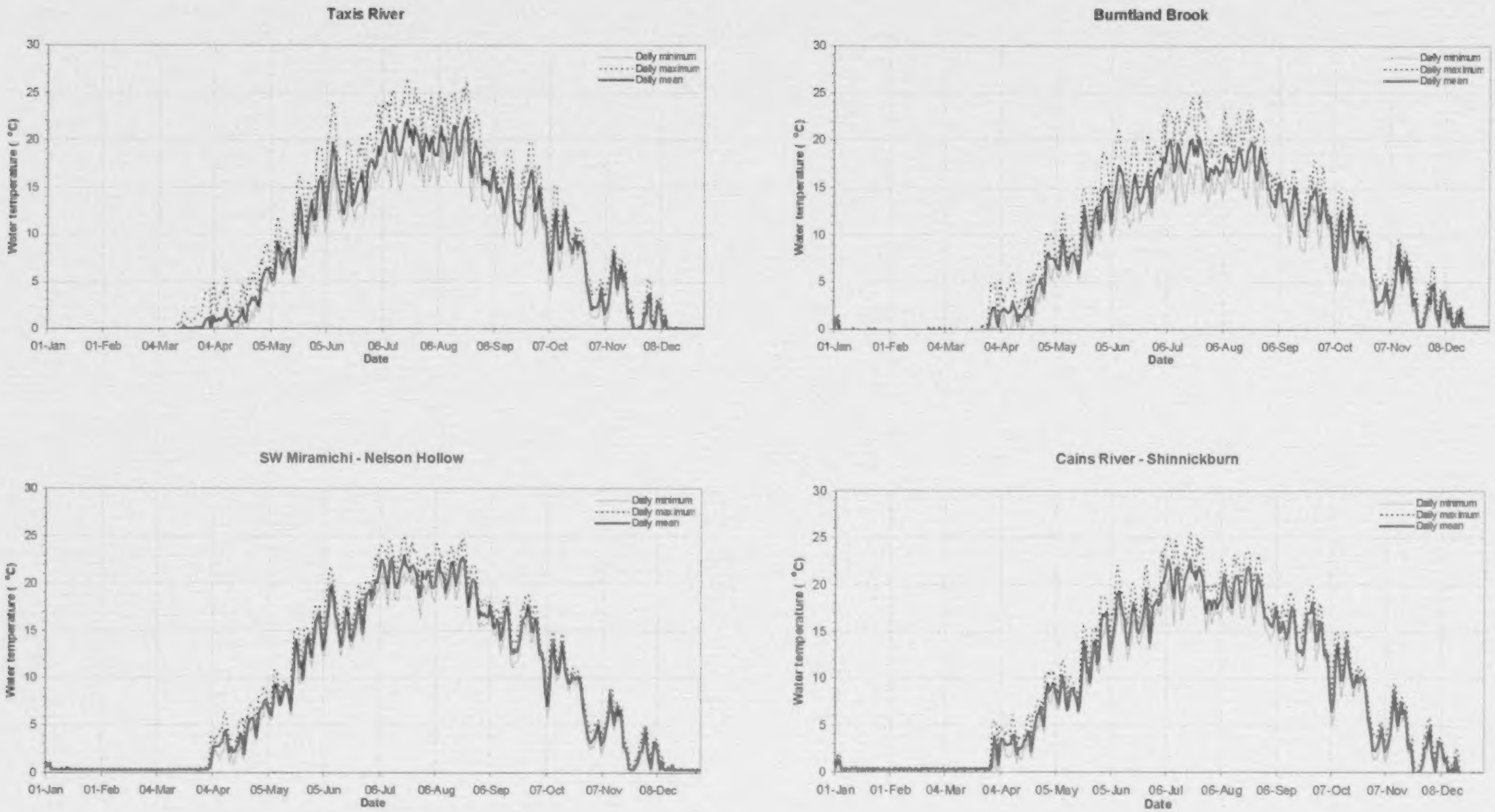


Figure 38. Daily water temperatures (mean, minimum, maximum) from various locations in the Southwest (SW) Miramichi watershed in 2011.

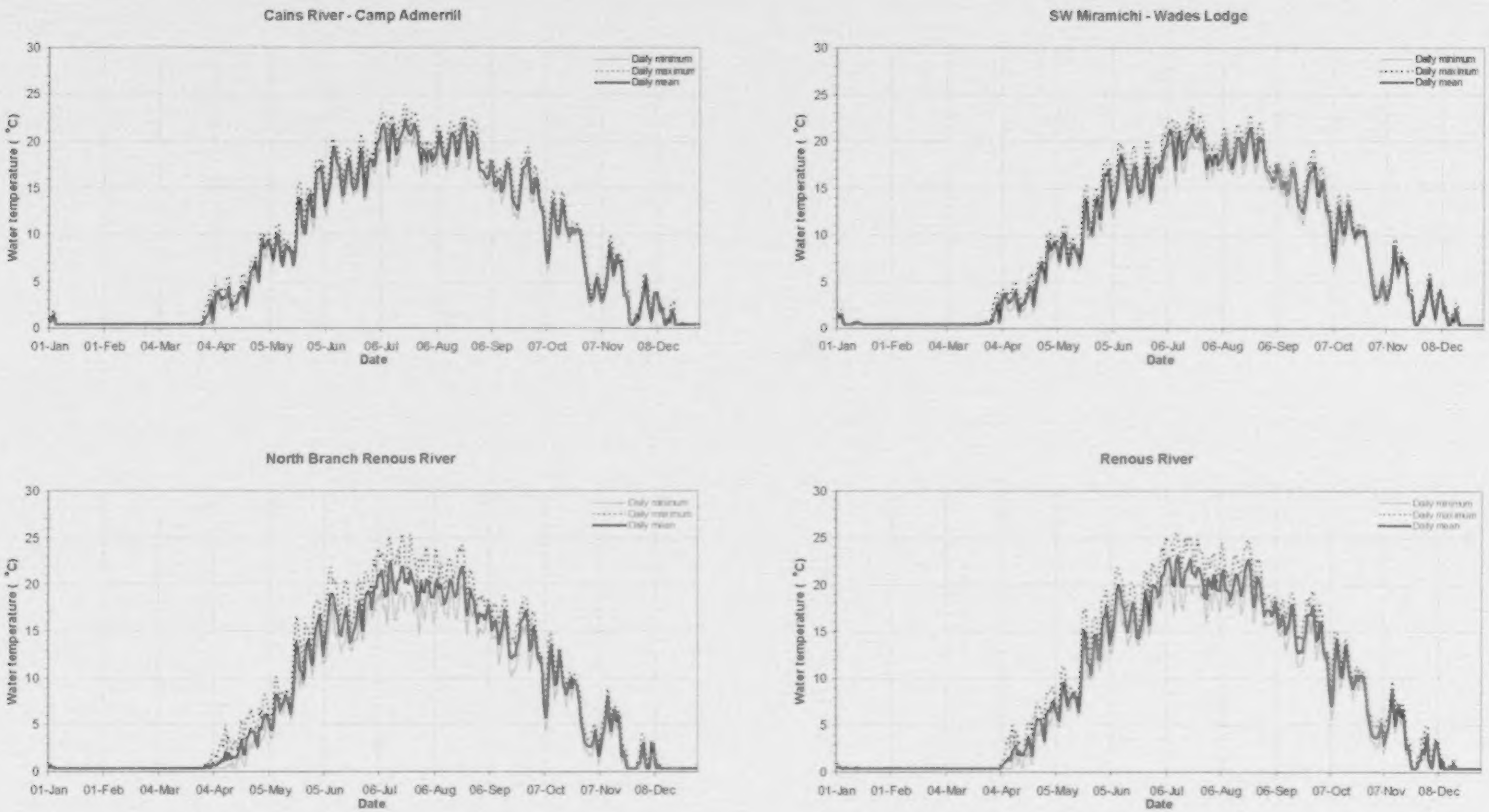
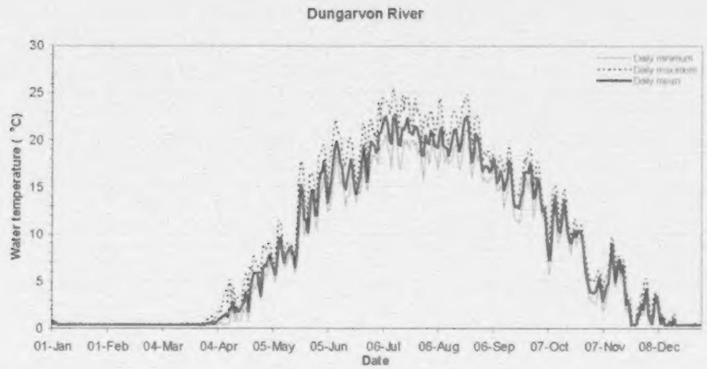


Figure 38. cont'd. Daily water temperatures (mean, minimum, maximum) from various locations in the Southwest (SW) Miramichi watershed in 2011.



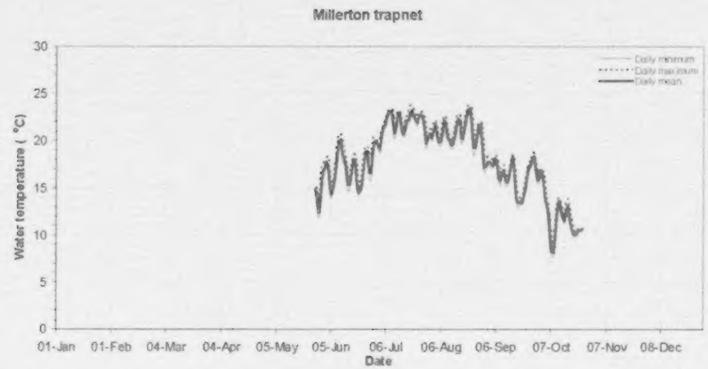


Figure 38. cont'd. Daily water temperatures (mean, minimum, maximum) from various locations in the Southwest Miramichi watershed in 2011.

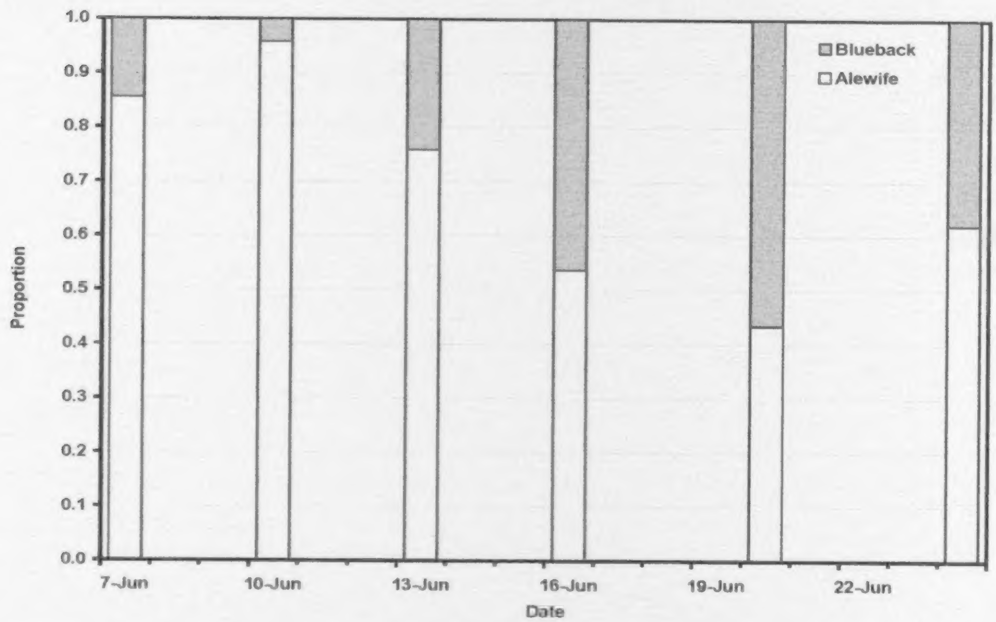


Figure 39. Proportion alewife and blueback herring in the commercial gaspereau fishery of the Northwest Miramichi River in 2011.

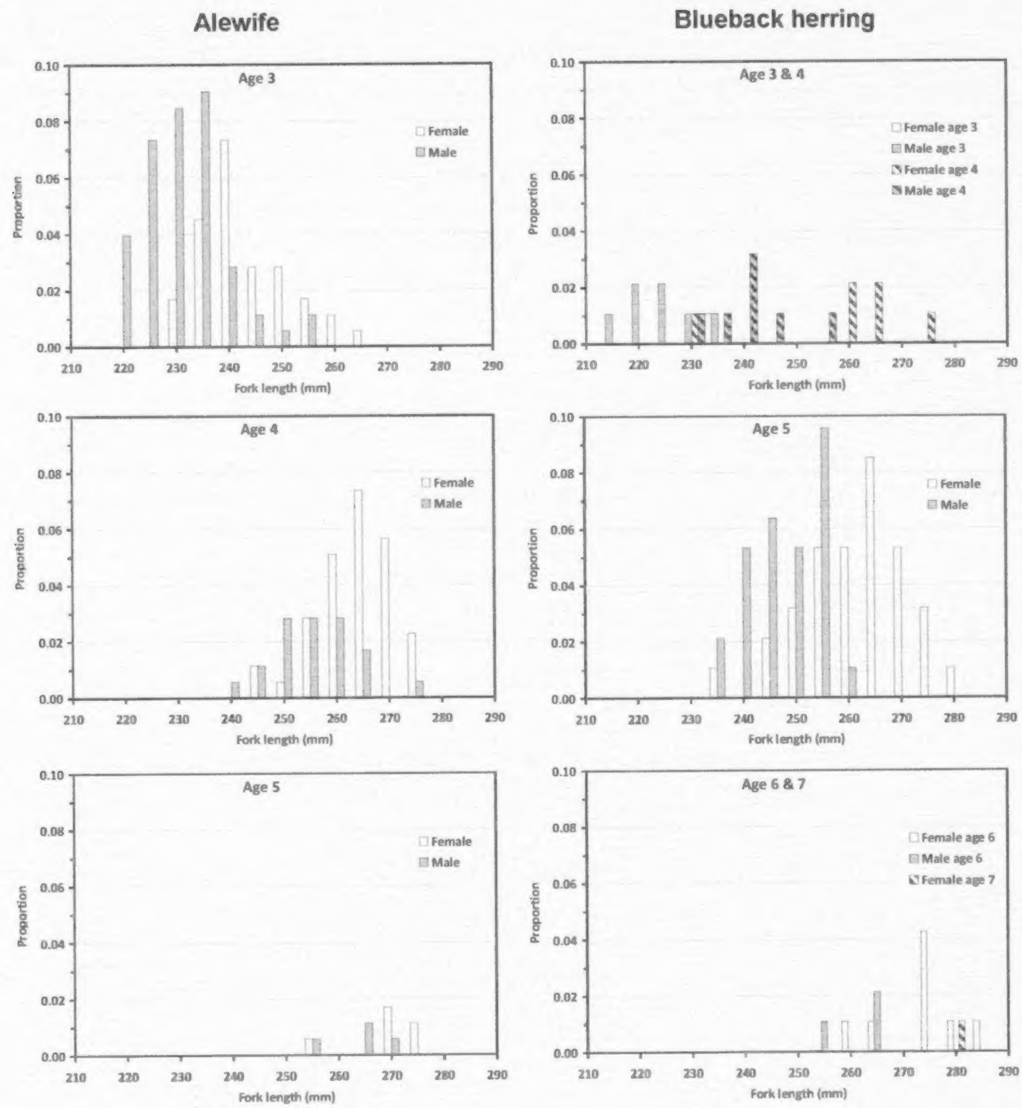


Figure 40. Length distribution of alewives and blueback herring by age and sex in detail samples collected from the commercial gaspereau fishery of the Northwest Miramichi in 2011.

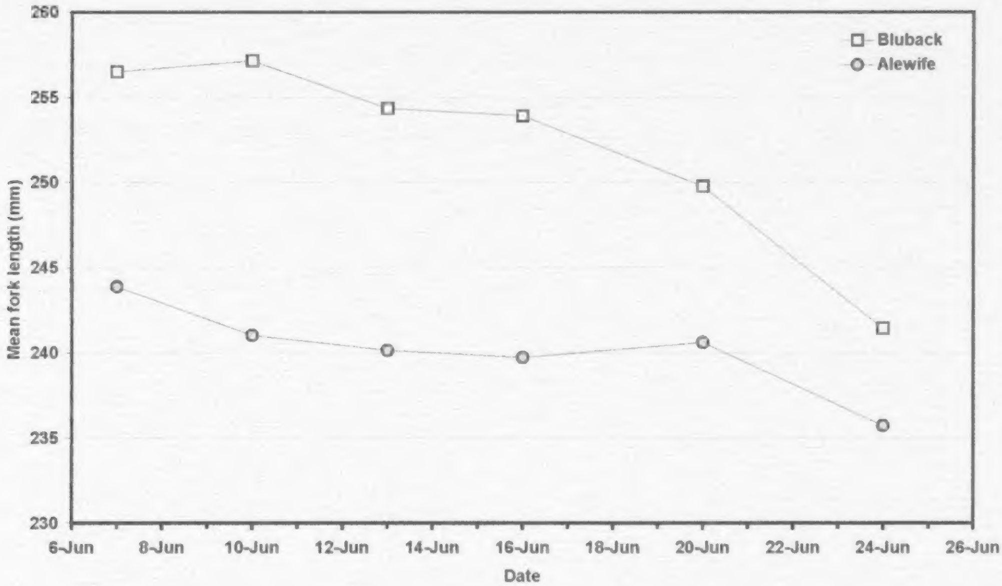


Figure 41. Mean fork length of alewives and blueback herring sampled in the Northwest Miramichi estuary over the course of the gaspereau season in 2011.

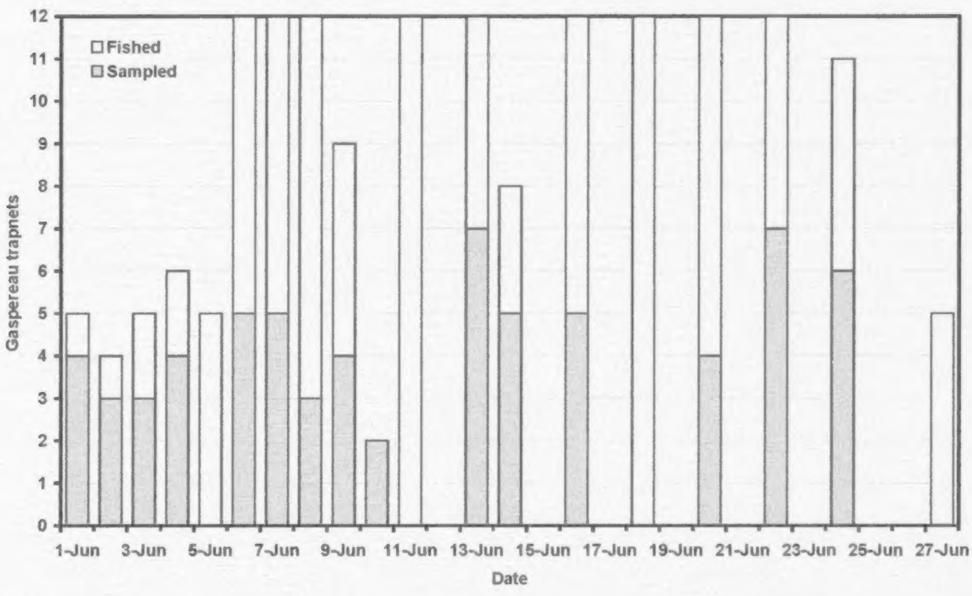


Figure 42. The number and timing of gaspereau trapnets sampled for striped bass bycatch relative to the number and timing of gaspereau trapnets fished by commercial fishermen in the Northwest Miramichi estuary in 2011.

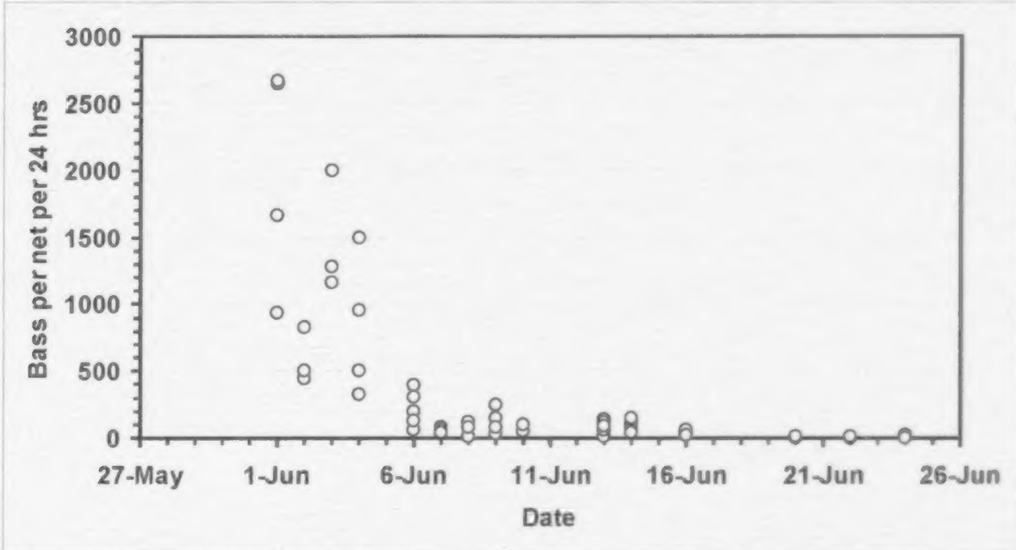


Figure 43. The number of striped bass captured per net per day in the commercial gaspereau fishery of the Northwest Miramichi estuary in 2011.

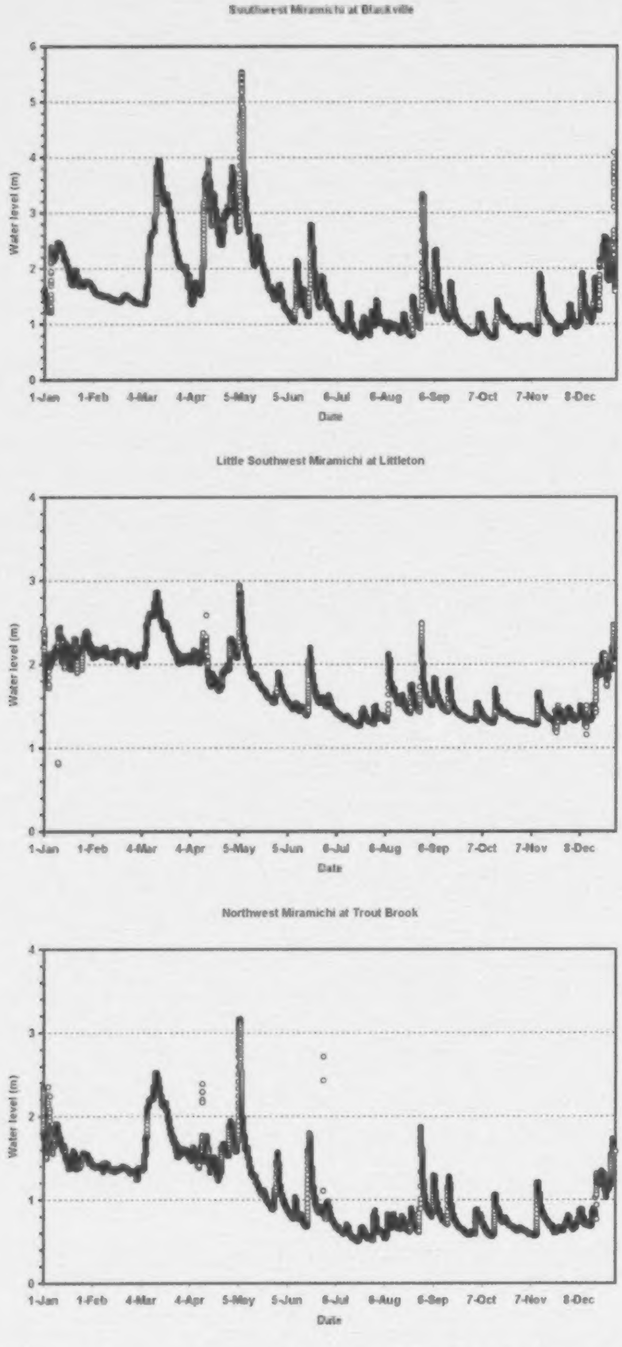


Figure 44. Hourly water levels recorded at Environment Canada stations on the Southwest Miramichi at Blackville (upper), the Little Southwest Miramichi at Lyttleton (middle) and on the Northwest Miramichi at Trout Brook (lower) in 2011.

Appendix 1. English version of the response letter sent to anglers who have returned Carlin tag recapture information to the DFO.

Fisheries and Oceans - Science Branch - Gulf Region
P.O. Box 5030
Moncton, N.B. CANADA
E1C 9B6

date

Angler
Address

RE: ADULT SALMON TAGGING, MIRAMICHI RIVER, N.B.

The Department of Fisheries and Oceans, in co-operation with the Eel Ground First Nation and the Northumberland Salmon Protection Association, is attaching tags to salmon captured at research traps on the estuaries of the Northwest and Southwest Miramichi rivers. The purpose of this program is to determine the exploitation rate, distribution, and run timing of salmon during their spawning migration into tributaries of the river. Information from tag recaptures is used to estimate the number of salmon returning to the river each year.

The following table and attached map indicate the history of the fish corresponding to the tag(s) you returned.

Tag Number		
Wild or Hatchery		
Fork Length in cm.(at tagging)		
Date Tagged		
Location Tagged		
Date Recaptured		
Location Recaptured		

Your name will automatically be entered (once for **each** tag) in the North Atlantic Salmon Conservation Organisation (NASCO) lottery (held around June) where there is a $2500 (US) and a $1000 (US) prize for North America as well as several smaller prizes.

If you would like any further information or if any of this information is incorrect then do not hesitate to call me collect at 1-506-778-2837 or send an email to: dfo representative@dfo-mpo.gc.ca. Thank-you for your co-operation.

Sincerely,

DFO representative